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Abbreviations and Acronyms

--	not analyzed/not applicable
<	“less than”
>	“greater than”
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MPN/100 ml	most probable number per 100 milliliters
ppm	parts per million
ug/L	micrograms per liter
AJ	heavier hydrocarbon than diesel
Alpha	Alpha Analytical Laboratories
AWA	Amador Water Agency
AWS-Ione	Amador Water System—Ione
BOD	biological oxygen demand
BMP	best management practice
BS-#	baseline sample-number
BTEX	benzene, toluene, ethylbenzene, and xylene
CCTV	closed-circuit television
CDCR	California Department of Corrections and Rehabilitation
Center Corridor	central utility corridor
CGP	Construction General Permit
COC	constituents of concern
COD	chemical oxygen demand
CTC	Correction Treatment Center
CVRWQCB	Central Valley Regional Water Quality Control Board
DI	drop inlet
DI-WET	de-ionized water
DNA	deoxyribonucleic acid
E/CMH-#	electrical/communication utility vault
EI/EIo	Eocene Ione Formation
EPA	U.S. Environmental Protection Agency
ESL	environmental screening level
Exterior Perimeter Road	MCSP exterior perimeter road
FIB	fecal indicator bacteria
GT-#	guard tower-number
HCFIP	Health Care Facility Improvement Project
HDPE	high-density polyethylene
IGP	Industrial General Permit
J	estimated value
Jgo	Jurassic Gopher Ridge Volcanics
JSS	Jurassic Salt Springs Slate
LACP	Lateral Assessment and Certification Program
LEF	Lethal Electrified Fence

Abbreviations and Acronyms (continued)

Main Drainage Basin	includes “A” Yard; B Yard; the central utility corridor; portions of the MCSP support facilities located north of the exterior perimeter road; and the former Guard Tower 2 (GT-2) drainage basin, which includes the main entrance plaza
MBAS	methylene blue active substances
MCIC	Mule Creek and Infill Complex
MCL	maximum contaminant level
MCSP	Mule Creek State Prison
MO	Main Outfall
MRZ	mineral resource zone
MST	microbial source tracking
N	ammonia as nitrogen
NAL	numeric action limits
NASSCO	National Association of Sewer Service Companies
ND	not detected
NRCS	National Resource Conservation Service
OES	Office of Emergency Services
Old Prison Facility	Facilities "A," B, and C and their accompanying yards
Order	Water Code Section 13267 Order
PACP	Pipeline Assessment and Certification Program
pH	hydrogen potential
PVC	polyvinyl chloride
Qm_2	Quaternary Modesto Formation, upper unit
RCP	reinforced concrete pipe
RfD	reference dose
Sample and Analysis Plan	*Standard Operating Procedures and Sample and Analysis Plan,* March 12, 2019
Sampling Plan	revised sampling plan submitted October 15, 2018, and conditionally approved by CVRWQCB on November 6, 2018
SCCWRP	Southern California Coastal Water Research Program
SCCWRP Study Plan	Southern California Coastal Water Research Program Proposed Sampling Design for Addressing Microbiology Concerns in Mule Creek, January 27, 2019
Secondary Drainage Basin	includes C Yard and eastern portion of main entrance
SFRWQCB	San Francisco Bay Regional Water Quality Control Board
SMC	Source Molecular Corporation
SO	secondary outfall
STLC	soluble threshold limit concentration
SVOC	semi-volatile organic compound
SSMH-#	sanitary sewer manhole-number
SWMH-#	stormwater manhole-number
SWPPP	stormwater pollution prevention plan
SWRCB	State Water Resource Control Board
TCLP	Toxicity Characteristic Leaching Procedure
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TPHD	total petroleum hydrocarbons as diesel

Abbreviations and Acronyms (continued)

TPH-K	total petroleum hydrocarbons as kerosene
TPHMO	total petroleum hydrocarbons as motor oil
TSS	total suspended solids
TTLC	total threshold limit concentration
USDA	U.S. Department of Agriculture
USGS	United States Geologic Survey
VOC	volatile organic compound
WDID	waste discharge identification number
Work Plan	March 2018 stormwater collection system investigation work plan
WWTP	wastewater treatment plant

1.0 Introduction

This revised document presents the results of the stormwater collection system investigation conducted at the Mule Creek State Prison (MCSP). This report was developed by SHN on behalf of the California Department of Corrections and Rehabilitation (CDCR), as requested in the Water Code section 13267 Order (Order), dated February 14, 2018, by the Central Valley Regional Water Quality Control Board (CVRWQCB).

The site investigation was performed in general accordance with the March 2018 stormwater collection system investigation work plan (Work Plan) (SHN, March 2018) as revised in October 2018 and March 2019.

Following completion of the initial study (January 2018–June 2018), CDCR and CVRWQCB staff met on October 11, 2018. During the meeting, CVRWQCB staff agreed to revise the sampling requirements. On October 15, 2018, CDCR submitted a revised sampling plan (Sampling Plan) to the CVRWQCB, and on November 6, 2018, CVRWQCB conditionally approved the Sampling Plan. In February 2019, CDCR agreed to expand the CCTV inspection throughout the facility. CVRWQCB also agreed to take into consideration the recommendations of the Southern California Coastal Water Research Program (SCCWRP) Study Plan.

The site investigation is presented in five sections and provides the following information:

- **Chapter 1** is the introduction and includes background information on MCSP, local geology, the stormwater collection system, and the construction stormwater pollution prevention plan for the MCSP Culvert Installation Project.
- **Chapter 2** summarizes all of the investigation activities associated with the stormwater collection system investigation.
- **Chapter 3** presents the results from the site investigation.
- **Chapter 4** presents conclusions from the investigation.
- **Chapter 5** presents recommendations.

Figures for this report are presented in Appendices 1, 3, 8, 15, and 23. Tables are included in Sections 2.0, 3.0, and 4.0; and Appendices 2, 4, 8, 14, 15, and 23 of this report.

1.1 Objective

The objective was to investigate the stormwater collection system, understand the layout of the existing stormwater collection system piping network, identify the source of non-stormwater entering the stormwater collection system, and provide recommendations to address.

1.2 Site Information

The prison is located at 4001 Highway 104, Ione, in Amador County, California (Figure 1-1). Stormwater runoff is collected in drop inlets (DIs) within the prison and routed to a perimeter stormwater collection system referenced as the “Perimeter Ditch” (Figure 1-2), which discharges into two separate vegetated swales at two locations, identified as the “Main” outfall (MCSP6) near Guard Tower 3 (GT-3), the “Secondary” outfall (MCSP5) located near Guard Tower 9 (GT-9). These swales each eventually discharge into Mule Creek at the discharge locations MCSP2 and MCSP3, respectively. These two outfalls are associated with their own drainage basin with the same designation. The Main Drainage Basin includes “A” Yard; B Yard; the central utility corridor (Center Corridor); portions of the MCSP support facilities located

north of the exterior perimeter road (Exterior Perimeter Road); and the former Guard Tower 2 (GT-2) drainage basin, which includes the western portion of the main entrance plaza (Figure 1-3). The Secondary Drainage Basin includes C Yard and the eastern portion of the main entrance plaza. A site plan of MCSP with a building index is included as Appendix 3.

The Perimeter Ditch is surrounded by the Exterior Perimeter Road, and bounded on the interior by the Lethal Electrified Fence (LEF). Inside of the LEF is the secured MCSP facility, which includes three yards ("A," B, and C Yards), the housing units associated with each yard, the Center Corridor, which includes the A/B and B/C Center Corridors, and the Central Services and Plaza Area, which is the primary non-vehicular entrance to MCSP. The area between the housing units and the LEF is off-limits to inmates. The Interior Perimeter Road is located in the off-limits area between the housing units and LEF.

The area between the Interior and Exterior Perimeter Roads is partially covered with gravel. There is rilling of exposed soil in this area of the prison. The Center Corridor is the location of the primary support facilities inside MCSP including kitchens, vocational training, and associated prison industries including meat packing and coffee roasting. The Interior Perimeter Road and the Center Corridor are the primary routes of both the wet and dry utilities including water, stormwater collection system, sanitary sewer collection system, electrical, and communications. MCSP has a stormwater collection system which consists of stormwater lines, DIs, and stormwater manholes (SWMHs). The sanitary sewer collection system consists of sanitary sewer lines, sanitary sewer manholes (SSMHs), grease waste lines, grease traps, and pump stations.

1.2.1 Geologic Setting

The prison is situated at the margin between the western foothills of the Sierra Nevada mountain range and the Central Valley geomorphic provinces at an elevation range of approximately 270 feet in the southwest corner to 650 feet in the northeast corner of the property.

According to published geologic maps (Figure 1-4), the prison property footprint is located primarily on two geologic formations: the Eocene Ione Formation (map symbol EI or EIo) and the Jurassic Gopher Ridge Volcanics (Jgo). Two additional subordinate formations located on the prison property are the Quaternary Modesto Formation, upper unit (Qm_2), and the Jurassic Salt Springs Slate (JSS). The two primary geologic units located at the prison, Ione and Gopher Ridge, are further described below.

1.2.1.1 Ione Formation

The following description of the Ione Formation is from the United States Geologic Survey Open-File Report 2006-1378 (2007):

> The Ione Formation is commonly differentiated from adjacent units by its mineralogy. The most characteristic mineral throughout the Ione is the pearly-lustered granular kaolinite, up to very coarse sand size, known as "anauxite." Quartz is abundant, in some sections to the near exclusion of other framework minerals. Feldspar content varies considerably, although not as simply as previous literature might suggest. Heavy mineral suites are characterized by the stable minerals ilmenite, zircon, andalusite, and rutile. Thus beds that are quartzose, anauxitic or otherwise kaolinitic, and with mature heavy mineral suites are likely to be Ione; the presence of as much as 20 percent fresh or altered feldspar, however, is to be expected. (USGS, 2007)

The following minerals and chemical formulas are associated with the Ione Formation:

- Kaolinite: $Al_2Si_2O_5(OH)_4$
- Anauxite: $Al_4Si_4O_{10}(OH)_8$
- Ilmenite: $FeTiO_3$
- Zircon: $ZrSiO_4$
- Andalusite: Al_2SiO_5
- Rutile: TiO_2

Below are descriptions of two Ione Formation industrial mineral deposits (clay and lignite) from the 1983 Division of Mines and Geology publication Mineral Land Classifications of the Sutter Creek 15 Minute Quadrangle, Amador and Calaveras Counties:

> **Clay**: One of the most important clay resource areas in California is located in the Ione area along a twelve-mile long, two-mile wide belt underlying the western margin of the study area. The clay is mined from the Middle Eocene Ione Formation which locally also contains commercial grade specialty sand and lignite (described below). Most of the clay deposits contained in the Ione Formation are of the kaolinite group (Pask and Turner, 1952). These deposits have been utilized mainly as fire clays since clay was first mined here in the 1840's by John Sutter. Other uses of Ione clay include production of calcined kaolin, filler clays, paper filler clays, bond clays, mortars, roofing and floor tile, clay pipe, and specialty clays for refractories. Also mined from the Ione Formation are pisolitic clay deposits, which, because of their appearance and high iron-aluminum content, are locally referred to as "laterite." These deposits, are an important source of iron-aluminum additive material for several cement producers in northern California. Although the Ione Formation has been mined for use in ceramic raw material at a number of localities along the Sierra Nevada foothills, the Ione area is the only place where high grade refractory and relatively pure kaolinitic clays of any extent have been found or mined. (DMG, 1983)
>
> **Lignite**: Lignite is a carbonaceous material that is intermediate in grade between peat and subbituminous coal. It is present in the Ione Formation as discontinuous, arcuate-shaped beds interlayered with clay and sand. Lignite deposits of the Ione area represent the only source of montan wax in the United States. An extraction product of lignite, montan wax is a hard substance with a high melting point and is used in carbon paper inks, polishes, and lubricants. (DMG, 1983)

The following mineral with its approximate chemical formula is associated with the clay deposit described above:

- Laterite: $Al_2Si_2O_5(OH)_4 + FeO_2$

The following information is associated with the lignite described above:

- Lignite: low-grade coal with >50% by weight carbon
- Montan wax: composition is non-glyceride long-chain (C24-C-30) carboxylic acid esters (62-68%), free long-chain organic acids (22-26%), long-chain alcohols, ketones, and hydrocarbons (7-15%), and resins.

1.2.1.2 Gopher Ridge Volcanics

The following description of the Gopher Ridge Volcanics is from the California Geologic Survey Preliminary Geologic Map of the Ione 7.5 Minute Quadrangle (2015):

> Consists mainly of massive mafic and intermediate tuff, breccias, and occasional greywacke and agglomerate. Likely Oxfordian in age (Clark, 1964).

Below are descriptions of mineral deposits formed by volcanogenic processes that are associated with volcanic rocks found within the footprint of the prison facility. These descriptions are from the 1983 Division of Mines and Geology publication Mineral Land Classifications of the Sutter Creek 15 Minute Quadrangle, Amador and Calaveras Counties:

> A segment of the foothill copper-zinc belt of the western Sierra Nevada extends through the western half of the Sutter Creek quadrangle. The belt in total is defined by a widespread group of polymetallic sulfide deposits associated with felsic pyroclastic rock horizons present in the Gopher Ridge and Copper Hill Volcanics, and the associated Smartville Volcano-plutonic complex (Kemp, 1982). The deposits are stratabound, commonly stratiform, accumulations of iron sulfides, mainly pyrite, mixed with varying amounts of chalcopyrite, sphalerite, galena, and precious metals. Mineralization was associated with subaqueous hydrothermal exhalative systems related to island arc volcanism venting mineralizing fluids at the sea water-rock interface. Most of the deposits are similar in mineralogy, morphology, and metal zoning to the Kuroko-type (Zn-Pb-Cu) and Noranda-type (Zn-Cu) volcanogenic deposits (Kemp, 1982). Ore grades within the deposits commonly average 2 to 5 percent copper, 2 to 15 percent zinc, 1 to 2 percent lead, 2 to 5 oz/ton silver, and 0.01 to 0.05+ oz/ton gold. Some deposits are enriched in precious metals with sulfide ore commonly assaying in excess of 0.10 oz/ton gold and 10 oz/ton silver (Jenkins, 1948).
>
> The foothill copper belt includes about 20 notable mines and a host of smaller ones; together they have produced almost 200 million pounds of copper and 50 million pounds of zinc. Most mining activity in the belt occurred during the Civil War, World War I, and World War II (DMG, 1983).

The following minerals with their chemical formulas are associated with the above description:

- Pyrite: FeS_2
- Chalcopyrite: $CuFeS_2$
- Sphalerite: (Zn,Fe)S
- Galena: PbS

1.2.1.3 Summary of Geologic Conditions

As described in the above sections, the geology of the Ione area includes numerous abundant minerals that include the metals aluminum, iron, copper, and zinc, as well as low-grade coal deposits (lignite).

According to the Amador County General Plan, 3 mineral resource zones (MRZ) exist in Amador County as classified by the State Geologist: MRZ-2a, MRZ-2b, and MRZ-3a.

The following is taken from the California Surface Mining and Reclamation Policies and Procedures Guidelines for Classification and Designation of Mineral Lands:

> MRZ-2a—Areas underlain by mineral deposits where geologic data show that significant measured or indicated resources are present. As shown on the diagram of the California Mineral Land Classification System, MRZ-2 is divided on the basis of both degree of knowledge and economic factors. Areas classified MRZ-2a contain discovered mineral deposits that are either measured or indicated reserves as determined by such evidence as drilling records, sample analysis, surface exposure, and mine information. Land included in the MRZ2a category is of prime importance because it contains known economic mineral deposits. A typical MRZ-2a area would include an operating mine, or an area where extensive sampling indicates the presence of a significant mineral deposit.
>
> MRZ-2b—Areas underlain by mineral deposits where geologic information indicates that significant inferred resources are present. Areas classified MRZ-2b contain discovered deposits that are either inferred reserves or deposits that are presently sub-economic as determined by limited sample analysis, exposure, and past mining history. Further exploration work and/or changes in technology or economics could result in upgrading areas classified MRZ-2b to MRZ-2a. A typical MRZ-2b area would include sites where there are good geologic reasons to believe that an extension of an operating mine exists or where there is an exposure of mineralization of economic importance.
>
> MRZ-3a—Areas containing known mineral deposits that may qualify as mineral resources. Further exploration work within these areas could result in the reclassification of specific localities into the MRZ-2a or MRZ-2b categories. MRZ3a areas are considered to have a moderate potential for the discovery of economic mineral deposits. As shown on the diagram of the California Mineral Land Classification System, MRZ-3 is divided on the basis of knowledge of economic characteristics of the resources. An example of a MRZ-3a area would be where there is direct evidence of a surface exposure of a geologic unit, such as a limestone body, known to be or to contain a mineral resource elsewhere but has not been sampled or tested at the current location.

The following information is from the Amador County General Plan, Section 4.6-11 Geology, Soils, Mineral Resources, & Paleontological Resources:

> The most important zone with respect to the presence of [mineral] resources is MRZ-2, which is defined as “areas where adequate information indicates that significant mineral (aggregate) deposits are present (2a) or where it is judged that there is a high likelihood for their presence (2b).” This zone is applied to known mineral deposits or where well-developed lines of reasoning, based on economic geologic principles and adequate data, demonstrate that the likelihood for occurrence of significant mineral deposits is high.
>
> As shown in Exhibit 4.6-4 (Appendix 5), a large gold deposit runs along SR 49. To the west of the gold deposit, approximately centered on the city of Ione, a large area contains a variety of minerals including sand, clay, lignite, copper, zinc and gold. Smaller areas of substantial mineral deposits containing limestone, load gold, talc, and gold are scattered around the remainder of the western portion of Amador County.

1.3 Background

MCSP opened in June 1987 and since that time has been owned and operated by CDCR. Through 2015, the prison consisted of Facilities "A," B, and C (Figure 1-2) and their accompanying yards (Old Prison Facility). The Old Prison Facility accommodated approximately 2,800 inmates. In 2016, the prison expanded by constructing the 1,584-inmate Mule Creek Infill Complex (MCIC), just east of the Old Prison Facility.

In July 2017, construction for MCSP Culvert Installation Project began. The project included the removal of short extensions of existing culverts, and the installation of new storm drain piping and precast drain inlets within an existing approximately ½-mile long drainage ditch along the western perimeter of the facility. On January 4, 2018, the CVRWQCB inspected the MCSP facility and determined the grading activities associated with the culvert installation comprised more than 1 acre. During the inspection, the CVRWQCB collected two surface water samples (GT-4 and Junction [GT-3]) from the Perimeter Ditch at the site to assess water quality (Figure 1-5).

On January 4, 2018, CVRWQCB inspected MCSP. The inspection was conducted in response to a complaint regarding an unpermitted construction project. During the inspection, CVRWQCB identified that the construction project had disturbed greater than one acre. CVRWQCB explained the Construction General Permit (CGP) requirements to MCSP staff. Additionally, CVRWQCB discussed the types of best management practices (BMPs) typically installed on construction projects and the sampling and monitoring requirements. CVRWQCB emphasized the importance of stabilizing the construction project when complete. CVRWQCB observed that the construction project had no stormwater management BMPs, and there had not been any monitoring and sampling. During the inspection, CVRWQCB collected water samples from GT-4 (Tower 4) and GT-3 (Junction).

On January 18, 2018, the MCSP warden received an email from CVRWQCB regarding the January 4, 2018, inspection and included the results of the two water samples collected during the inspection. Based on the results of the two water samples collected on January 4, 2018, CVRWQCB alleged that MCSP was, in fact, discharging grey water, sewage, or a mixture. The January 18, 2018, email further stated "Based on these results, the discharge of this wastewater to Mule Creek must cease immediately. All water discharging from this drainpipes (sic) must be contained and properly disposed of at your POTW. No water from this pipeline may be discharged to land or to surface water without a permit. Furthermore, because this appears to be sewage, CDCR must prevent human contact with this wastewater."

Also on January 18, 2018, the facility received a Notice of Non-Compliance from the CVRWQCB for grading activities greater than 1 acre, and the CVRWQCB required MCSP to obtain coverage under the CGP.

On January 19, 2018, MCSP ceased non-storm event discharges from the stormwater collection system (including the Main and Secondary Outfalls) of the Old Prison Facility and implemented sampling of the stormwater collection system in response to the January 18, 2018, email from the CVRWQCB (Appendix 6).

On February 14, 2018, MCSP received the Order from the CVRWQCB (Appendix 6). The CVRWQCB alleged: "The water quality samples collected by Board staff demonstrate that the water being discharged from the Old Prison Facility to the perimeter storm water collection system, and then into Mule Creek, is, at least partially, wastewater comingled with contaminated storm water and/or gray water." (CVRWQCB, February 2018).

1.4 Existing Stormwater Collection System

MCSP provided SHN with the available drawings of the existing stormwater collection system onsite (Appendix 3). The existing stormwater collection system historically flowed to an earthen Perimeter Ditch (Perimeter Ditch) that collected runoff from the Old Prison Facility and drained into three outfalls near GT-2, GT-3, and GT-9. In December 2018, the outfall near GT-2 was permanently blocked, thus rerouting flows from the GT-2 Drainage Basin into the Main Drainage Basin. This eliminated the GT-2 Drainage Basin as an individual drainage basin, leaving only two outfalls, the primary outfall located near GT-3 (Main Outfall) and the secondary outfall located near GT-9 (Secondary Outfall). It is estimated that three-quarters of the drainage area flows to the Main Outfall and one-quarter of the drainage area flows to the Secondary Outfall. The stormwater collected at each of the outfalls travels through culverts under the Exterior Perimeter Road to earthen channels that flow to Mule Creek.

The high points of the Perimeter Ditch and breaking points are located at Guard Tower 7 (GT-7) and Guard Tower 1 (GT-1). It should be noted that a portion of the Exterior Perimeter Road drains into the perimeter culvert. A stormwater collection line runs through the center of the Old Prison Facility by way of the Center Corridor that runs from manhole SWMH-514 to SWMH-501 (upstream to downstream, respectively; Figure 1-3). The MCSP Culvert Installation Project has filled in the western portion of the Perimeter Ditch (from GT-2 to GT-6).

1.4.1 Stormwater Collection to Outfall GT-3 (Main Drainage Basin)

The Main Drainage Basin is 64.2 acres and collects runoff from the "A" Yard, B Yard, and Center Corridor. The Main Outfall Drainage Basin conveys stormwater runoff from high points west of GT-2 in the south, and GT-7 in the north, to the low point near GT-3 (Figure 1-3). This drainage basin consists of three main components that convey water to the Main Outfall:

1) the Perimeter Ditch that flows from GT-7 (toward GT-6) to GT-3;
2) the Perimeter Ditch that flows from west of the entrance plaza to GT-3; and
3) stormwater collection system, which conveys stormwater from the Center Corridor within the prison to the Perimeter Ditch at GT-4.

The outfall near GT-2 was part of the MCSP Culvert Installation Project and was temporarily closed in February 2018, as directed by the CVRWQCB. As briefly mentioned in Section 1.4 the outfall near GT-2 was permanently blocked in December 2018. The drainage area between GT-1 and GT-2 ponds and is either pumped to the sanitary sewer or flows around GT-2 to the existing channel between GT-2 and GT-3. As described in Section 1.4.3, a percentage of stormwater is redirected to the Main Drainage Basin during storm events.

The Main Outfall discharges through a culvert under the Exterior Perimeter Road to an earthen channel that flows into Mule Creek approximately 50 feet upstream from the Mule Creek Bridge on Highway 104.

1.4.1.1 Perimeter Ditch GT-7 to GT-3

Stormwater runoff from Facility "A" and B yard areas is collected in DIs, which are connected by stormwater lines to the perimeter of the yards and the Perimeter Ditch (See Figure 1-3). Between GT-7 and GT-6, runoff from the Facility B building roofs and exterior area between the Facility B buildings and the LEF sheet flows down the Interior Perimeter Road towards the west where it is either collected by DIs or flows through the LEF to the Perimeter Ditch at GT-6. Between GT-6 and GT-3, the outer Facility "A" and B building roofs and

exterior area located between Facility "A" and B buildings sheet flows to the Interior Perimeter Road, which is equipped with DIs and culverts. The DIs and culverts along the Interior Perimeter Road area are connected to the new perimeter stormwater culvert that runs from GT-6 to GT-3, located within the Perimeter Ditch. Between GT-6 and GT-3, the area between the LEF and the Interior Perimeter Road sheet flows under the LEF to the Perimeter Ditch. The Perimeter Ditch has a series of DIs spaced along the stormwater collection system from GT-6 to GT-3. These DIs flow into the new perimeter stormwater culvert. At GT-4, stormwater from the Center Corridor enters the perimeter stormwater culvert.

The Perimeter Ditch from GT-7 to GT-5 collects stormwater from the paved areas in front of the Prison Industrial Authority/general warehouse, the vehicle maintenance shop, and the fire station, which are located outside of the secure facility and across the Exterior Perimeter Road. Runoff from these areas collect in DIs as well as sheet flows into the Perimeter Ditch (Figure 1-3).

The Exterior Perimeter Road is paved and crowned from GT-5 to GT-3. Stormwater runoff from half of the roadway sheet flows into the Perimeter Ditch. The other half of the road flows to areas outside of the stormwater collection system.

1.4.1.2 Perimeter Ditch West of Plaza Entrance to GT-3

Stormwater runoff from a portion of the Facility "A" Yard is collected in DIs and is plumbed to the Perimeter Ditch (Figure 1-3). A portion of the "A" Yard perimeter building roofs, some runoff from the "A" Yard, and the land area located between "A" Yard buildings and LEF sheet flows to the Interior Perimeter Road. The Interior Perimeter Road is equipped with DIs and culverts. The DIs and culverts along the Interior Perimeter Road are connected to the Perimeter Ditch. The Perimeter Ditch has a series of DIs from GT-2 to GT-3.

Surface runoff in the yard between the LEF and building D1 (near the plaza entrance) is collected in DIs and connected to the Perimeter Ditch at GT-2.

The Exterior Perimeter Road is crowned from GT-2 to GT-3 and stormwater runoff from half of the roadway sheet flows into the Perimeter Ditch. The other half of the road flows to areas outside of the stormwater collection system.

The GT-2 sub-Drainage Basin is 3.8 acres and collects runoff from a portion of the area between the "A" Yard housing units and the western portion of the main plaza entrance to MCSP. This section of the Perimeter Ditch conveys stormwater runoff from GT-1 to the GT-2 Outfall in the southern portion of the facility (Figure 1-3).

Historically, the GT-2 Outfall was its own basin and was culverted under the outside perimeter road to the grassy area to the south (at the facility entrance), then flowed by way of an underground culvert to the west, where it met the same earthen ditch to which the Main Outfall Drainage Basin contributes.

In response to the Order, the GT-2 Outfall was permanently closed in December 2018. During storm events, the GT-2 Drainage Basin (which previously discharged at GT-2 Outfall) ponds and is either pumped to the sanitary sewer cleanout at GT-2 or flows past GT-2 to the Main Outfall. Because GT-2 outfall was permanently closed in December 2018 and the runoff now flows to GT-3, the GT-2 sub-Drainage Basin has been incorporated into the Main Drainage basin leaving only two drainage basins and two outfalls to Mule Creek.

1.4.1.3 Center Corridor

The Center Corridor is a paved area that is located between Facilities "A," B, and C, and contains a stormwater collection line that runs from SWMH-514 to SWMH-501 (Figure 1-3). The Center Corridor stormwater collection line flows into the Perimeter Ditch at GT-4. The Center Corridor stormwater collection system collects stormwater from DIs in the center of the Center Corridor, loading bays (except the Meat Packing and Facility C Kitchen, which are plumbed to the sanitary sewer), and the interior of MCSP, which runs from the Main Entrance, past Central Services, toward the B Yard. There are seven electrical/ communication vaults located in the Center Corridor, which discharge to the Center Corridor stormwater collection system. Additionally, the Correction Treatment Center (CTC) French drain and four groundwater sumps located in the CTC light well discharge to the Center Corridor stormwater collection system.

1.4.2 Stormwater Collection to Outfall GT-9 (Secondary Drainage Basin)

The Secondary Drainage Basin is 21.3 acres and collects runoff from the C Yard. The Secondary Drainage Basin Perimeter Ditch channels stormwater runoff from high points GT-1 and GT-7 to the low point at GT-9 (Figure 1-3). The Secondary Outfall is an earthen channel that flows into Mule Creek approximately 450 feet upstream from the Mule Creek Bridge on Highway 104.

In this drainage area, stormwater runoff from Facility C collects in DIs and is piped to the Perimeter Ditch. The storm drainage from the Facility C yard is composed of a series of DIs and stormwater lines.

The Exterior Perimeter Road is paved and crowned from GT-7 to GT-9. Stormwater runoff from half of the road sheet flows into the Perimeter Ditch. The other half of the road flows to areas outside of the stormwater collection system. The entire Exterior Perimeter Road surface is sloped toward the Perimeter Ditch between GT-9 and GT-1.

1.4.3 Stormwater Bypass Pumping

On January 19, 2018, MCSP closed the two gates located at the Main Outfall and blocked the Secondary Outfall and the GT-2 Outfall. Electric and/or engine driven pumps were placed at the outfalls to redirect stormwater flow into the facility's sanitary sewer collection system. During significant rain events, the pumps remained operational but the gates were opened. MCSP notified the California Office of Emergency Services of water discharged to Mule Creek during these significant rain events (Appendix 7).

On March 14, 2018, three 21,000-gallon Baker tanks were delivered to MCSP and an additional seven Baker tanks were delivered on March 16, 2018. On March 22, 2018, four additional Baker tanks were delivered for added storage in the event that stormwater could not be contained in the Perimeter Ditch. Stormwater contained in the Baker tanks was pumped into the sanitary sewer collection system for treatment. As the OES reports in Appendix 7 indicate, the storage volume required to contain a significant storm event could not be met with 294,000 gallons of storage provided by the 14 Baker tanks. Subsequently, the tanks were removed from the site the week of July 9, 2018.

1.5 Stormwater Pollution Prevention Plan

1.5.1 Construction SWPPP

A construction Stormwater Pollution Prevention Plan (SWPPP) was prepared by Geosyntec Consultants for the MCSP Culvert Installation Project, which consists of construction activities outside of the western half of the LEF. A CGP Notice of Intent was certified by the legally responsible person on April 10, 2018, and the

State Water Resources Control Board issued waste discharge identification number (WDID) 5S03C383033 on April 12, 2018. On April 17 and 18, 2018, Geosyntec Consultants oversaw the installation of best management practices (BMPs) at the facility. On May 7, 2018, SHN conducted BMP training for facility personnel.

2.0 Site Investigation Activities

In an attempt to identify the alleged illicit discharges into the stormwater collection system, SHN conducted various site investigation activities at MCSP, which included:

1. Conducting a physical survey of both the sanitary sewer and stormwater collection systems within the secured area (2018)
2. Reviewing maintenance logs from MCSP staff dating back to 2003
3. Reviewing improvements or changes made to the stormwater and collection systems dating back to 2001
4. Conducting physical inspection of the sanitary sewer and stormwater collection systems in the central corridor (2018) including:
    a. Dye testing
    b. manhole inspections,
    c. CCTV investigation, and
    d. smoke testing
5. Conducting a site audit of facility practices (2018)
6. Collecting stormwater samples from the stormwater collection system
7. Collecting soil samples from the stormwater collection system

After submitting the initial stormwater collection system report of findings in August of 2018, CDCR and CVRWQCB met in October 2018 to discuss the report and agreed on scope for additional investigation. Additional investigation activities included:

1. Continued review of maintenance logs, system repairs, and facility practices
2. Continued sampling of the stormwater collection system (at the primary and secondary outfalls)
3. Supplemental CCTV investigation of MCSP within the secured area not covered in 2018, and the warehouse area to the north
4. Developing a plan for and conducting supplemental biological monitoring and associated flows (to be submitted in fall 2020)
5. Supplemental survey of structures not surveyed in 2018 including areas outside of the secured area, or were not accessible during the 2018 survey effort (to be conducted in fall 2019)

2.1 Stormwater and Sanitary Sewer Collection Systems Survey and Mapping

Preliminary mapping of the stormwater and sanitary sewer collection systems and DIs was addressed in the March 2018 work plan. SHN has worked with MCSP to compose a detailed map of aspects of the

stormwater collection system that were missing from previous maps, which consist primarily of DIs located in Facility "A," B, and C yards, as well as the connectivity of DIs located in loading bays in the Center Corridor, the Perimeter Ditch, and the off-limits area between the housing area and the LEF.

To create the updated map, SHN performed a survey of the MCSP stormwater structures located within the LEF as well as those in the Perimeter Ditch. This survey was completed on the weeks of April 16, May 1, May 21, and July 23, 2018. In 2018, to the best of SHN and MCSP staff's knowledge, the Perimeter Ditch and all of the DIs and catch basins that collect and convey stormwater from the secured area into the Perimeter Ditch were surveyed and mapped. The sanitary sewer manholes within the Center Corridor and along the Interior Perimeter Road were also surveyed and mapped. The updated survey drawing is included in Appendix 8.

During the 2019 closed-circuit television (CCTV) efforts, additional structures were identified in the stormwater and sanitary sewer collection systems. These structures were not found during the 2018 sitewide survey, primarily because they were either buried (and not part of the 2018 CCTV inspection) or were located outside of the scope of the 2018 survey. These additional structures have not yet been surveyed as to location or depth; therefore, their placement on the maps is approximate. Additionally, connectivity between structures was updated as CCTV inspections verified pipe locations and connections. SHN is scheduled to survey these additional structures in the fall of 2019. Amended survey data will be provided in the spring of 2020. A table identifying the structure type, the system (storm drain or sanitary sewer), and associated ID number given during the CCTV work is presented in Appendix 8.

2.2 Maintenance Logs

Available maintenance logs for the Old Prison Facility plumbing and stormwater collection systems, which span from 2003 to the present, are displayed in Appendix 9. The records were reviewed for entries relevant to MCSP. Starting in 2018, additional activities were initiated and documented (Appendix 9) including

- inspections and maintenance of facility grounds,
- maintenance activities associated with reducing bird nesting, and
- maintenance of grease traps.

A further discussion of the maintenance logs is located in Section 3.2.

2.3 Timeline of Changes

A timeline of changes made to the stormwater and sanitary sewer collection systems was summarized from MCSP's available records (spanning from 2001 to the present) and is included in Appendix 10. A further discussion of the timeline of changes is contained in Section 3.3.

2.4 Stormwater and Sanitary Sewer Collection Systems Physical Investigation

Physical investigations of the stormwater and sanitary sewer collection systems were conducted:

- to determine if cross-connections between the stormwater and sanitary sewer collection systems were present,
- to evaluate the structural condition of the pipelines and manholes, and
- to assess the potential for leakage or infiltration.

The investigations included:

1. dye testing (sanitary sewer)—Center Corridor;
2. manhole inspection (stormwater and sanitary sewer)—Center Corridor;
3. CCTV inspection (stormwater and sanitary sewer)—
    a. 2018 (Phase I) Center Corridor, and
    b. 2019 (Phase II) MCSP facility including Center Corridor laterals; and
4. smoke testing (sanitary sewer)—Center Corridor and Perimeter.

CCTV and smoke testing were conducted by NorCal Pipeline Services of Fairfield, California (California State License Board Number 935878). The operators who conducted the inspections are certified by the National Association of Sewer Service Companies (NASSCO) for assessment of mainlines, pipelines, and laterals. Licenses and certifications for NorCal Pipeline Services and their operators are presented in Appendix 11.

The stormwater collection system is shown on Figure 1-3, and a survey drawing of the collection system is presented in Appendix 8. The sanitary sewer inventory is shown on Figure 1-6.

2.4.1 Dye Testing

On February 8, 2018, MCSP staff conducted preliminary dye testing within the Center Corridor sanitary sewer collection system. Dye testing was also performed by MCSP staff on the loading dock catch basins outside of the meat packing and kitchen facilities in the B/C Center Corridor on April 19, 2018. The tests were conducted by placing liquid dye into the wastewater collection system. MCSP staff used a different color dye on each yard and used light to inspect stormwater manholes and outfalls to the culvert at GT-4. Dye testing was performed in the Center Corridor system and not on any other lines in the facility. This method of testing is qualitative and is used to determine connectivity of pipe systems. Because dye testing is limited to general connectivity observations, it cannot precisely locate pipe defects or determine pipeline condition. Therefore, these qualitative dye tests were an attempt to identify whether obvious connection(s) between the sanitary sewer and stormwater collection systems exist within the Center Corridor.

2.4.2 Manhole Inspections

Stormwater and sanitary sewer collection system manholes (designated as SWMH and SSMH, respectively) in the Center Corridor were inspected for structural integrity and infiltration potential during the weeks of March 26, April 9, and May 14, 2018. The inspections were completed from the surface and consisted of visually assessing the cover, frame, cone, wall, bench, and channel of the manhole.

2.4.3 Closed-Circuit Television

2.4.3.1 2018 (Phase I)

CCTV inspection of the Center Corridor stormwater and sanitary sewer collection systems were conducted by NorCal Pipeline Services during the weeks of April 9, May 14, and June 11, 2018. NorCal Pipeline Services is a California-licensed general engineering contractor, and their CCTV operators are NASSCO certified for defect classification pertaining to stormwater and sanitary sewer collection systems (Appendix 11). The lines to be inspected were prepared by cleaning with multiple passes of high pressure jet nozzles and, if necessary, isolating upstream flows with inflatable plugs. Water and debris recovered during cleaning efforts was transported to the onsite wastewater treatment plant (WWTP) for disposal.

Typically, the CCTV camera was launched from the upstream manhole to the downstream manhole; however, reverse surveys were performed if obstructions in the line prevented the camera from traveling the entire pipe length from the initial launched direction. The CCTV operator navigated the camera through the pipe, identifying features and defects in accordance with NASSCO Pipeline Assessment and Certification Program (PACP) standards. Where possible, sewer laterals crossing the storm drain alignment were inspected with a lateral launching CCTV transporter and defects were documented according to NASSCO Lateral Assessment and Certification Program (LACP) standards.

2.4.3.2 2019 (Phase II)

In 2019, additional CCTV investigation was conducted. The objective of the 2019 CCTV efforts was to map the remaining sanitary sewer and stormwater collection systems (including laterals) that were not inspected in 2018 per the agreement. CCTV inspection of the stormwater and sanitary sewer collection systems (including grease waste lines) was conducted by NorCal Pipeline Services in 2019 beginning the week of March 18 through to the end of August 2019. Additional areas surveyed in 2019 included the "A," B, C, and D yards, as well as the off-limits area located on the exterior perimeter of the housing units and inside the LEF. Procedures for inspections were similar to those outlined above in the 2018 work period.

2.4.4 Smoke Testing

Smoke testing of the sanitary sewer system in the Center Corridor was performed by NorCal Pipeline services on May 14, 2018, and in the perimeter on July 23 and 24, 2018, according to the NASSCO smoke testing procedures. The testing equipment included a high capacity blower, smoke candles, and sandbags. The procedure included isolating a section of sanitary sewer line with sandbags, securing the blower to a manhole within the isolated section, placing smoke candles in the blower's air intake, and then walking the test area identifying and categorizing smoke returns. (NASSCO, 2010).

2.4.5 Observed Facility Practices

As part of this investigation in 2018, onsite observations were made, records were reviewed, and MCSP personnel were interviewed concerning practices at MCSP by facility personnel, inmate workers, and construction workers that may contribute to sediment transport and/or should be considered illicit discharges. The observed practices are discussed in Section 3.4.3.

2.5 Stormwater Collection System - Water Sampling

Water sampling has been ongoing at various locations at the facility since January 2018. Daily water sampling (in general accordance with the Order and Work Plans conditionally approved by the CVRWQCB) began in January 2018 and continued until October 2018.

Following completion of the initial study (January 2018–June 2018), CDCR and CVRWQCB staff met on October 11, 2018. During the meeting, CVRWQCB staff agreed to reduce the then-current sampling requirements. On October 15, 2018, CDCR submitted a revised sampling plan to the CVRWQCB and on November 6, 2018, CVRWQCB conditionally approved the revised sampling plan.

Sampling frequency was reduced from daily to monthly (second Wednesday of each month). Monthly samples would be collected from Mule Creek at the northern fence line (also known as Mule Creek NP, Upstream, and MCSP1), GT-3 outfall (also known as Guard Tower 3, MO, and Junction/Outfall), GT-9 outfall (also known as Guard Tower 9, secondary outfall, and SO), and from Mule Creek at the downstream location

(also known as Loc3, Downstream, MCDS, and MCSP4). In addition to monthly, samples would be collected prior to and once during any sufficiently large storm event that required the outfall gates to be opened.

MCSP staff continued sampling from October 2018 until March 2019 when Confluence Environmental Field Services took over the sampling responsibilities.

On March 12, 2019, CDCR submitted a report titled *Standard Operating Procedures and Sample and Analysis Plan* (Sample and Analysis Plan) proposing standard operating procedures for surface water flow measurements and for groundwater and surface water sampling and analysis for implementation of the SCCWRP Proposed Sampling Design for Addressing Microbiology Concerns in Mule Creek (SCCWRP Study Plan).

Also on March 12, 2019, staff from SHN, SCCWRP, CDCR, and CVRWQCB met to discuss implementation of the SCCWRP Study Plan prepared by SCCWRP that would add sampling locations, sampling events, and laboratory analyses aside from the conditionally approved October 2018 sample plan. This SCCWRP Study Plan does not supersede the conditionally approved October 2018 sample plan but augmented the October 2018 sample plan as discussed below.

Four additional sampling locations would be added to the sampling program for the SCCWRP study: MCSP2, MCSP3, MCSP5, and MCSP6. MCSP5 is at the culvert outflow from the secondary outfall. MCSP2 is located in a grassy swale approximately 600 feet down-flow from MCSP5 and just prior to Mule Creek. MCSP6 is at the culvert outflow from the Main Outfall. MCSP3 is located in a grassy swale approximately 1,300 feet down-flow from MCSP6 and just prior to Mule Creek.

Two sample locations have been renamed for the SCCWRP study samples: MCSP1 is located at the northern property limits (this location is also known as Mule Creek NP and Upstream). MCSP4 is located downstream (this location is also known as Loc-3, MCDS, and downstream). Sampling frequency changes included collecting samples subsequent to storm events, landscape irrigation events, and during dry weather events.

The following sections summarize the sampling activities that have taken place from January 2018 until August 2019. These sections describe the sampling locations within each of the two drainage basins, the sampling locations in the two drainage basin conveyances to Mule Creek, as well as the sampling locations along Mule Creek.

A site plan showing the drainage basins is included as Figure 1-3. A site map showing the sample locations is included as Figure 1-5. The survey mapping of the stormwater collection system is presented in Appendix 8.

During this investigation water samples were collected in laboratory-supplied samples bottles, immediately labeled (if not pre-labeled), placed in an ice-filled cooler, and submitted to the laboratory under appropriate chain-of-custody for analyses of one or more of the constituents shown in Tables 2.5-1 through 2.5-5.

Table. 2.5-1 Laboratory Analysis—Water
Organics
Mule Creek State Prison, Amador County, California

Constituent	Analytical Method	Date Sampling Began
Oil and grease	EPA[1] 1664A	1/25/2018
Total Petroleum Hydrocarbons as Diesel	EPA 8015DRO	1/25/2018
Total Petroleum Hydrocarbons as Gasoline[2]	EPA 8015B or 8260GRO	1/25/2018
Benzene	EPA 8015B or 8260B	1/25/2018
Toluene	EPA 8015B or 8260B	1/25/2018
Ethylbenzene	EPA 8015B or 8260B	1/25/2018
Total Xylenes	EPA 8015B or 8260B	1/25/2018
Volatile organic compounds	EPA 8260B	3/28/2018
Semi-volatile organic compounds	EPA 8270B	5/11/2018

1. EPA: U.S. Environmental Protection Agency
2. Analysis and reporting for total petroleum hydrocarbons as gasoline ceased as of 5/10/18

Table. 2.5-2 Laboratory Analysis—Water
Microbial
Mule Creek State Prison, Amador County, California

Constituent	Analytical Method	Date Sampling Began
Fecal Coliforms	SM[1] 9221B,E	1/19/2018
Total Coliforms[2]	SM 9221B,C	1/19/2018
E-coli	SM9223B	1/19/2018
Human Fecal	Human Bacterioidetes ID: Dorei	3/28/18, 4/27/18
Human Fecal	Human Bacterioidetes ID: EPA	3/28/18, 4/27/18
Bird Fecal	Bird Fecal ID	3/28/2018
Gull Fecal	Gull Fecal ID	3/28/2018
Ruminant Fecal	Ruminant Fecal ID: Target 1	3/28/2018

1. SM: Standard Method
2. Using a minimum of 15 tubes or three dilutions
3. Bi-weekly analysis also took place from 5/14/18 through 6/7/18

Table. 2.5-3 Laboratory Analysis—Water
General Chemistry
Mule Creek State Prison, Amador County, California

Constituent	Analytical Method	Date Sampling Began
Ammonia as N	SM[1]4500NH3C	1/25/2018
Total Alkalinity	SM2320B	1/25/2018
Bicarbonate Alkalinity	SM2320B	1/25/2018
Carbonate Alkalinity	SM2320B	1/25/2018
Hydroxide Alkalinity	SM2320B	2/16/2018
Biochemical Oxygen Demand$_5$[(2)]	SM 5210B	1/25/2018
Chloride	EPA[3] 300.0	1/25/2018
Residual Chlorine	SM4500-Cl F	2/16/2018
Chemical Oxygen Demand	SM5220D	1/25/2018
Electrical Conductivity	Field or SM2510B[1]	1/25/2018
Total Hardness	SM2340B	1/25/2018
Methylene blue active substances (MBAS)	SM 5540C	1/25/2018
Nitrate as N	EPA 300.0 or SM4500-NO3E	2/20/2018
Nitrite as N	SM4500-NO2 B	2/20/2018
Total Nitrogen	Calculated	2/16/2018
pH[4]	Field or SM4500-H+ B	1/25/2018
Orthophosphate as Phosphorus	EPA 300.0	1/25/2018
Total Settleable Solids	SM2540F	1/25/2018
Sulfate as SO_4	EPA 300.0	1/25/2018
Total Dissolved Solids	SM 2540C	1/25/2018
Total Kjeldahl Nitrogen	SM4500-Norg B	1/25/2018
Total Suspended Solids	SM 2540D	1/25/2018
Turbidity	SM2130B	1/25/2018
Volatile Dissolved Solids	EPA 160.4	1/25/2018
Phosphorus	SM4500-P E	1/25/2018
Fixed Dissolved Solids	SM 2540E	2/16/2018
Nitrate + Nitrite as N	SM4500-NO3 F	2/16/2018
Sulfide	SM4500-S2 D	1/25/2018

1. SM: Standard Method
2. BOD_5: 5-day biochemical oxygen demand
3. EPA: U.S. Environmental Protection Agency
4. pH: hydrogen potential

Table 2.5-4 Laboratory Analysis—Water
Total Metals
Mule Creek State Prison, Amador County, California

Constituent	Analytical Method	Date Sampling Began
Aluminum	EPA[1] 200.8	1/25/2018
Antimony	EPA 200.8	1/25/2018
Arsenic	EPA 200.8	1/25/2018
Barium	EPA 200.8	4/1/2018
Beryllium	EPA 200.8	4/1/2018
Cadmium	EPA 200.8	1/25/2018
Calcium	EPA 200.7	1/25/2018
Chromium	EPA 200.8	1/25/2018
Cobalt	EPA 200.8	4/1/2018
Copper	EPA 200.8	4/1/2018
Iron	EPA 200.8	1/25/2018
Lead	EPA 200.8	1/25/2018
Magnesium	EPA 200.7	1/25/2018
Manganese	EPA 200.8	1/25/2018
Mercury	EPA 245.1	4/23/2018
Molybdenum	EPA 200.8	4/1/2018
Nickel	EPA 200.8	1/25/2018
Selenium	EPA 200.8	1/25/2018
Silver	EPA 200.8	4/1/2018
Sodium	EPA 200.7	1/25/2018
Thallium	EPA 200.8	4/1/2018
Vanadium	EPA 200.8	4/1/2018
Zinc	EPA 200.8	1/25/2018

1. EPA: U.S. Environmental Protection Agency

Table 2.5-5
Laboratory Analysis—Water
Dissolved Metals
Mule Creek State Prison, Amador County, California

Constituent	Analytical Method	Date Sampling Began
Aluminum	EPA[1] 200.8	1/25/2018
Antimony	EPA 200.8	1/25/2018
Arsenic	EPA 200.8	1/25/2018
Cadmium	EPA 200.8	1/25/2018
Calcium	EPA 200.7	1/25/2018
Chromium	EPA 200.8	1/25/2018
Iron	EPA 200.7	1/25/2018
Lead	EPA 200.8	1/25/2018
Magnesium	EPA 200.7	1/25/2018
Manganese	EPA 200.8	1/25/2018
Nickel	EPA 200.8	1/25/2018
Selenium	EPA 200.8	1/25/2018
Sodium	EPA 200.7	1/25/2018
Zinc	EPA 200.8	1/25/2018

1. EPA: U.S. Environmental Protection Agency

2.5.1 Main Drainage Basin Water Sampling

Water samples collected during this investigation that are considered representative of the Main Drainage Basin include Center Corridor stormwater manholes; the CTC building French drain; electrical and communication vaults; a sewer lift station vault; irrigation runoff in drop inlets; and Perimeter Ditch outfalls GT-2, GT-3, GT-4, and GT-5. The water samples collected during this investigation are representative of both stormwater and potential non-stormwater in the stormwater collection system.

2.5.1.1 Center Corridor Stormwater Manholes

The Center Corridor stormwater manholes (SWMH-514 to SWMH-501 [Figure 1-3]) access the stormwater collection system lines that runs from Sally Port to the Perimeter Ditch at GT-4. The stormwater collection system lines in the Center Corridor collect stormwater from DIs in the center of the Center Corridor, loading bays, the Main Entrance, and Central Services.

On March 28 and 29, 2018 (during a dry weather period), grab-samples were collected by SHN from the Center Corridor manholes SWMH-502, SWMH-505, SWMH-508, and SWMH-511. These samples were collected approximately three days following a rain event, which occurred on March 25, 2018, ensuring that samples were primarily non-stormwater. The original complaint indicated discharges from the Center Corridor stormwater collection system were dark in color, with elevated temperature. Based on this allegation, samples were also collected for caffeine analysis upstream (SWMH-505) and downstream (SWMH-502*) of the coffee-roaster (Building A2) to evaluate if illicit discharges were originating from coffee roasting activities.

During sampling efforts at the Center Corridor stormwater collection system manhole SWMH-505 on March 28, 2018, SHN personnel observed an influx of water into the storm drain line. Prison facility personnel were immediately notified, and the source of the non-stormwater discharge was identified as a electrical vault sump. The electrical vault sump system is on a float switch and pumps what is most likely groundwater that accumulates in the electrical vaults and discharges to the stormwater collection system.

On April 27, 2018 (during dry weather), additional grab samples were collected by SHN from Center Corridor manholes SWMH-511 and SWMH-502*.

*Note: MCSP maintenance staff misidentified manhole SWMH-501 during the March 28 and 29 and April 27, 2018, sampling events; therefore, manhole SWMH-502 was inadvertently sampled instead of proposed sample location SWMH-501. Subsequently, field notes and chain-of-custody records refer to “MH-501.”

2.5.1.2 CTC Building French Drain

On May 3, 2018, grab-samples were collected by MCSP staff in the open area of the CTC building off of the B Yard and B/C Center Corridor, which is the open courtyard that the sumps for the CTC building drain, and discharges into the stormwater collection system (Figure 1-2). These samples were collected approximately 17 days following a rain event, which occurred on April 16, 2018.

2.5.1.3 Electrical/Communication Vaults

Two electrical vaults (Vault 2 and Vault 3) observed discharging into the Center Corridor stormwater collection system were sampled on April 9, 2018, and again on May 17, 2018.

On July 11 and 12, 2018, additional grab-samples were collected by MCSP staff from 16 utility vaults (C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-10, C-13, C-14, C-15, C-16, C-17, C-19, and C-20) within the Main Outfall Drainage Basin (Figure 1-7).

2.5.1.4 Landscape Irrigation Runoff

On July 18, 2018, grab-samples were collected by MCSP staff from drop inlets P161, P166, and PO A1, at approximately 1:30 am and 3:00 am near the end of scheduled landscape irrigation times to assess pesticide, herbicide, and fertilizer concentrations, if any, in landscape irrigation runoff.

2.5.1.5 GT-2

Surface runoff in the yard between the LEF and building D1 is collected in DIs and connected to the Perimeter Ditch at GT-2. Samples are collected near GT-2 from the water that drains from that area and ponds on the exposed soil within the Perimeter Ditch. The Exterior Perimeter Road also contributes to this ponded water during storm events. From January 2018 to August 2019, approximately 11 water samples were collected at this location.

2.5.1.6 GT-3

This sampling location is also known as Guard Tower 3, Junction/Outfall, and Main Outfall. The GT-3 sampling location is a small earthen collection basin within the Perimeter Ditch where two storm drain culverts empty out. These two culverts carry the water that is collected from the Main Drainage Basin stormwater collection system. The Exterior Perimeter Road also contributes to this sampling location during storm events. From January 2018 to August 2019, approximately 283 samples have been collected at this location.

2.5.1.7 GT-4

This location is also known as Guard Tower 4. The sampling location at GT-4 is the outfall from the Center Corridor stormwater collection system. From January 2018 to August 2019, approximately 229 samples were collected at this location.

2.5.1.8 GT-5

The sampling location at GT-5 represents runoff from the B Yard, GT-6, and GT-7, warehouse, fire hall, and vehicle maintenance. The Exterior Perimeter Road also contributes to this sampling location during storm events. From January 2018 to August 2019, approximately 6 samples were collected at this location.

2.5.2 Main Drainage Basin Conveyance to Mule Creek Water Sampling

During periods of heavy rain, the culvert gates at the GT-3 collection basin are manually opened to allow stormwater to flow from the Main Drainage Basin into Mule Creek. Stormwater first flows through two culverts then into a vegetated swale south of the Exterior Perimeter Road. Stormwater flows through the vegetated swale southeast and passes under the prison entrance road through a culvert then continues through a heavily vegetated area before emptying into Mule Creek.

As part of the SCCWRP Study Plan, two sampling locations (MCSP6 and MCSP3) were chosen to assess water quality as it leaves the Main Drainage Basin and moves through the vegetated swale. Water samples were collected from these two locations only when sufficient flow was observed.

2.5.2.1 MCSP6

MCSP6 is located at the outflow end of the two culverts that lead from the GT-3 collection basin and drain into the vegetated swale. Water from this sampling location is representative of the Main Drainage Basin, the GT-3 collection basin, as well as conditions within the culverts. From March 2019 to August 2019, approximately 3 samples were collected at MCSP6 because sufficient flow was observed.

2.5.2.2 MCSP3

MCSP3 is located approximately 1,300 feet down-flow from MCSP6 and approximately 50 feet up-flow from Mule Creek. Water from this sampling location may be representative of the Main Drainage Basin, the entire flow path within the vegetated swale, as well as conditions within the culverts. From March 2019 to August 2019, approximately 3 samples were collected at MCSP3.

2.5.3 Secondary Drainage Basin Water Sampling

Water samples were collected during this investigation that are considered representative of the Secondary Drainage Basin include GT-9 outfall (also known as Guard Tower 9 and secondary outfall) and select electrical/communication vaults and drop inlets within the Secondary Drainage Basin.

2.5.3.1 Electrical/Communication Vaults

On July 11 and 12, 2018, grab-samples were collected by MCSP staff from four utility vaults (C-12, C-18, C-21, and C-22) within the secondary outfall drainage basin (Figure 1-7).

2.5.3.2 Landscape Irrigation Runoff

On July 18, 2018, grab-samples were collected by MCSP staff from drop inlet P143 at approximately 1:30 am and 3:00 am near the end of scheduled landscape irrigation times to assess pesticide, herbicide, and fertilizer concentrations, if any, in irrigation runoff.

2.5.3.3 GT-9

The GT-9 sampling location is a small concrete collection basin within the Perimeter Ditch where two stormwater collection system culverts empty out. These two culverts carry the water that is collected from the Secondary Drainage Basin stormwater collection system including the C Yard, GT-1, Guard Tower 8 (GT-8), and GT-9. This sampling location is also known as GT-9 and Secondary Outfall. From January 2018 to August 2019, approximately 28 samples were collected at this location.

2.5.4 Secondary Drainage Basin Conveyance to Mule Creek Water Sampling

During periods of heavy rain, the culvert gates at the GT-9 collection basin are manually opened to allow stormwater to flow from the Secondary Drainage Basin into Mule Creek. Stormwater first flows through two culverts then into a vegetated swale east of the Exterior Perimeter Road. Stormwater then flows southeast then southwest through heavy vegetation before emptying into Mule Creek.

As part of the SCCWRP Study Plan, two sampling locations (MCSP5 and MCSP2) were chosen to assess water quality as it leaves the Secondary Drainage Basin and moves through the vegetated swale. Water samples were collected from these two locations only when sufficient flow was observed.

2.5.4.1 MCSP5

MCSP5 is located at the outflow end of the two culverts that lead from the GT-9 collection basin and drain into the vegetated swale. Water from this sampling location is representative of the Secondary Drainage

Basin, the GT-9 collection basin, as well as conditions within the culverts. From March 2019 to August 2019, approximately 14 samples were collected at MCSP5 because sufficient flow was observed.

2.5.4.2 MCSP2

MCSP2 is located approximately 600 feet down-flow from MCSP5 and approximately 50 feet up-flow from Mule Creek. Water from this sampling location is representative of the Secondary Drainage Basin, conditions within the culverts, as well as the entire flow path within the vegetated swale. From March 2019 to August 2019, approximately 3 samples were collected at MCSP2 because sufficient flow was observed.

2.5.5 Mule Creek Water Sampling

From January 2018 to August 2019, water samples were collected from Mule Creek from three locations (upstream, midstream, and downstream).

2.5.5.1 Upstream

The upstream sampling point is located at the northern property boundary where Mule Creek flows onto the property. This location has been identified as Mule Creek NP, Upstream, and MCSP1 during this investigation. This location is representative of water flowing from off site and upstream of the prison property. The properties directly upsteam of the prison are predominantly open land and used for cattle grazing. From January 2018 to August 2019, approximately 34 water samples were collected from this location.

2.5.5.2 Midstream

The midstream sampling point is located beneath the bridge leading to the MCIC. This location has been identified as Loc-1 and Upstream during the initial phase of this investigation. This location is representative of surface water flowing into and through the vegetated areas between this sampling location and the northern property line. From March to May 2018, approximately 7 water samples were collected from this location.

2.5.5.3 Downstream

The downstream sampling point is located beneath the Highway 104 bridge beyond the southern property boundary where Mule Creek leaves the prison. This sampling point has been identified as Loc-3, MCDS, downstream, and MCSP4 during this investigation. This location is representative of surface water flowing into and through the vegetated areas of Mule Creek from this sampling location to the midstream location, the main and Secondary Drainage Basins, the vegetated swale conveyances from the main and secondary drainages, surface runoff from parking lots, and surface runoff from the Highway 104 roadway and shoulder. From January 2018 to August 2019, approximately 42 water samples were collected from this location.

2.5.6 Molecular Source Tracking

Bacteriological samples have been collected and analyzed since January 2018 as part of this investigation. Results indicate that a source exists that is contributing to elevated fecal coliforms in water samples collected at the Perimeter Ditch outfalls as well as other locations sampled at the prison facility. Because the bacteriological results do not distinguish between human or other sources, CDCR submitted water samples to specialized laboratories in Florida and Southern California to help identify the source(s) of the bacteria.

2.5.6.1 Bio Marker Sampling (SMC 2018)

In order to identify the source of the fecal coliform detected in water at the facility, samples collected on March 28 and 29, 2018, from the Center Corridor manholes, the Perimeter Ditch outfalls, and from a potable water source, were submitted to Source Molecular Corporation (SMC) for qualitative analysis of human, bird, gull, and ruminant animal biomarker microbial source tracking (MST). SMC is an ISO 17025 accredited MST laboratory located in Miami, Florida.

On April 27, 2018, grab-samples were collected by SHN from three locations along Mule Creek (Mule Creek NP, Loc-1 and Loc-3) and submitted to SMC for MST analysis. These samples were collected approximately 10 days following a rain event (0.40 inches), which occurred on April 16, 2018, ensuring that samples were primarily non-stormwater.

Additionally, on April 27, 2018, SHN collected and submitted solid (Bird 1 through 7) and wastewater (Headworks) samples for MST control group analysis. SHN collected bird scat samples for a local bird (swallow) population positive control and MCSP staff collected a sewage influent sample from the headworks for a human population positive control.

To increase confidence in qualitative MST results, samples were collected twice weekly by MCSP staff for human and bird MST analysis from Mule Creek (Mule Creek NP) and GT-3 from May 14, 2018, through June 7, 2018. A site map showing these sample locations is included as (Figure 1-8).

Samples for qualitative MST analysis were collected in two, 100-milliliter laboratory-supplied sterile bacteria analysis vials or in new 4-ounce Nasco Whirl-Pak® plastic bags. All sample bottles or bags were immediately labeled (if not pre-labeled), placed in an ice-filled cooler, submitted to the laboratory under appropriate chain-of-custody, and analyzed for one or more of the constituents listed in Table 2.5-2.

2.5.6.2 Bio Marker Sampling (SCCWRP 2019)

Beginning in March 2019 water samples were collected from select locations and submitted to the SCCWRP for quantitative MST analysis as part of the SCCWRP Study Plan. The sampling locations have been discussed in previous sections in this report and the sampling program is discussed in more detail in the SCCWRP Study Plan. The SCCWRP study is ongoing and a report of findings will be submitted under separate cover in fall of 2020 as Appendix 24 to this report.

2.5.7 Baseline Water Sampling

Water samples were collected during this investigation to establish baseline conditions from the domestic water supply and wastewater from MCSP to compare analytical results with the water samples collected from the main and Secondary Drainage Basin sampling locations and points of compliance.

2.5.7.1 Domestic Water

Domestic water for MCSP is provided by the Amador Water Agency's (AWA) Amador Water System–Ione (AWS-Ione). The water source for the AWS-Ione is from the north fork of the Mokelumne River and Tanner Reservoir. The Ione pipeline transports raw water from the Tanner Reservoir to the Ione Water Treatment Plant where it is treated and piped to MCSP. To establish baseline conditions of the domestic water supply, two baseline water samples were collected at MCSP.

On March 28, 2018, SHN collected grab-samples from the potable water spigot located at Building #C-2 at the MCSP Facility (sample ID: "background"). On June 12, 2018, SHN collected grab samples from a

potable water spigot located at the WWTP (sample ID: "background"). Oil and grease was added to the June 12, 2018 requested analyses, based on the numerous detections of oil and grease in the stormwater collection system.

These baseline samples were collected by allowing water to run for approximately 5-10 minutes prior to collection. A garden hose was connected to the spigot and used to direct the flow into a DI. After approximately 5-10 minutes, the garden hose was removed, and the baseline sample was collected directly from the spigot into the laboratory-supplied sample containers.

2.5.7.2 Wastewater Treatment Plant Sampling

To establish baseline conditions at the WWTP, samples were collected from the secondary clarifier, and the chlorine contact chambers.

On April 27, 2018, MCSP staff collected a grab sample from the WWTP secondary clarifier (secondary effluent). This sample was collected approximately 10 days following a rain event, which occurred on April 16, 2018, ensuring that sample was primarily non-stormwater.

Water samples were collected from the WWTP secondary effluent using a HDPE dipper cup attached to a plastic pole. The laboratory-supplied sample bottles were filled directly from the HDPE dipper.

On June 12, 2018, SHN collected two grab samples from the WWTP chlorine contact chambers (effluent). These samples were collected 19 days after a rain event, which occurred on May 25, 2018. In addition to establishing baseline conditions of the effluent, these two samples were also collected to determine if the HDPE dipper cup, used by WWTP staff to collect water samples, may have had any impact to the analytical results for water samples collected using the HDPE dipper cup. To determine this, water samples were collected from the WWTP chlorine contact chambers using two separate procedures:

- one set of sample bottles was filled using the HDPE dipper cup (effluent A) in the same manner performed by WWTP staff;
- and one set of sample bottles was filled by lowering a laboratory-supplied, unpreserved, 1-liter amber bottle into the chlorine contact chamber water and then once retrieved, decanting that water into the remaining laboratory-supplied sample bottles (effluent B).

A method blank sample was also collected on June 12, 2018, after using the HDPE dipper cup to collect water samples. First, the HDPE dipper cup was rinsed twice in distilled water then the method blank was collected by pouring distilled water into the dipper cup and then decanting that water into the laboratory-supplied sample containers.

2.5.7.3 Sanitary Sewer Lift Station

During the July 11 and 12, 2018, electrical utility vault sampling, a sanitary sewer lift station was inadvertently sampled near the B-7 building and labeled as Vault 4. This lift station was located in the B Yard, shown as SSMH-V4 on Figure 1-6, but is not part of the stormwater collection system. This structure is no longer a lift station, as the lift station structure was removed and converted back to a gravity sewer as originally designed after the July 2018 sampling event.

2.5.8 Storm Event Water Sampling

The investigation was expanded when storm events exceeded the capacity of the sanitary sewer lines to handle the excessive stormwater flows. Prior to these forecast storm events, the main and secondary outfall gates are opened to allow storm water to flow into Mule Creek. MCSP staff collects rainfall data as part of their WWTP Report of Waste Discharge reporting. Rainfall data for 2018 and 2019 is presented in Appendix 4, and the Office of Emergency Services (OES) reports for stormwater releases from MCSP are presented in Appendix 7.

2.5.8.1 Initial Study Storm Event Sampling

Table 2.5-1 lists the dates when water samples were collected during storm events prior to the October 2018 reduction in sampling frequency. This sampling was performed in general accordance with the Order and the Work Plan as conditionally approved by the CVRWQCB.

Table 2.5-6 Storm Sample Events During Initial Study
Mule Creek State Prison, Ione, California

Sample date(s)	Sample locations	24-hour rainfall amount
3/14/2018	GT-4[1], MO[2]	1.71
3/23/2018	Loc-1[3], Loc-3[4]	1.74
4/6, 7, and 11/2018	Loc-1, Loc-3	2.11
5/25, and 26/2018	Loc-1, Loc-3	0.31
10/4/2018	Loc-3	0.61

1. GT-4: Tower 4
2. MO: Main Outfall
3. Loc-1: midstream
4. Loc-3: downstream

2.5.8.2 October 2018 Sample Plan Storm Event Sampling

The following tables summarize the storm-event water samples collected subsequent to the October 2018 reduction in sampling frequency and prior to the March 2019 sample and analysis plan. Storm water sampling generally occurred prior to and during storm events in general accordance with the Order and the Sampling Plan as conditionally approved by the CVRWQCB.

Table 2.5-7 Storm Sample Events Subsequent to the October 2018 Sample Plan
Mule Creek State Prison, Ione, California

Sample date(s)	Sample locations	24hr rainfall amount
11/22/2018 (during storm)	MO[1]	1.52
11/23/2018 (during storm)	MO, SO[2], Downstream[3]	0.85
11/27/2018 (during storm)	MO	0.30
11/28/2018 (during storm)	MO, SO, Downstream	1.20
12/16/2018 (during storm)	MO	0.85
12/17/2018 (post storm)	MO, SO, Upstream[4], Downstream	0.85
1/4/2019 (pre storm)	MO	0.00
1/5/2019 (during storm)	MO, SO, Upstream	0.51
1/14/2019 (pre storm)	MO, SO	0.00
1/15/2019 (during storm)	MO, SO, Upstream, Downstream	0.60
1/19/2019 (pre storm)	MO, SO	0.02
1/20/2019 (during storm)	MO, SO, Upstream, Downstream	0.28
2/1/2019 (pre storm)	MO	0.75
2/2/2019 (during storm)	MO, SO, Upstream, Downstream	0.35
2/8/2019 (pre storm)	MO	0.00
2/10/2019 (during storm)	MO, SO, Upstream, Downstream	1.03
2/12/2019 (pre storm)	MO, SO	0.00
2/13/2019 (during storm)	MO, SO, Upstream, Downstream	0.93
2/24/2019 (pre storm)	MO, SO	0.00
2/26/2019 (during storm)	MO, SO, Upstream, Downstream	0.54

1. MO: Main Outfall (aka Junction / outfall, Guard Tower 3 [GT-3])
2. SO: secondary outfall
3. Downstream: beneath the Hwy 104 bridge, (aka MCSP4)
4. Upstream: at the northern most point on Mule Creek within the prison property.

2.5.8.3 March 2019 Sample and Analysis Plan Storm Event Sampling

The following water samples were collected and analyzed subsequent to the March 2019 meeting with the CVRWQB. Storm water sampling generally occurred prior to, during, and after storm events in general accordance with the Order, the Sampling Plan, and the Sample and Analysis Plan as conditionally approved by the CVRWQCB.

Table 2.5-8 Storm Sample Events Subsequent to the March 2019 Sample Plan
Mule Creek State Prison, Ione, California

Sample date(s)	Sample locations	24hr rainfall amount
3/18/2019 (pre storm)	MO[1]	0.00
3/20/2019 (during)	MO, SO[2], Upstream[3], Downstream[4]	0.27
4/4/2019 (pre storm)	MO, MCSP5[5]	0.00
4/5/2019 (during storm)	MO, MCSP5, Upstream, Downstream	0.18
4/8/2019 (post storm)	MO, MCSP2[6], Upstream, Downstream	0.03
4/17/2019 (post storm)	MO, MCSP5, Upstream, Downstream	0.00
5/14/2019 (pre storm)	MO, MCSP5	0.02
5/16/2019 (during storm)	MCSP2, MCSP3, Upstream, Downstream	0.60
5/20/2019 (post storm)	MCSP2, MCSP3, Upstream, Downstream	0.07

1. MO: Main Outfall (aka Junction / outfall, Tower 3)
2. SO: secondary outfall
3. Upstream: at the northern most point on Mule Creek within the prison property.
4. Downstream: beneath the Hwy 104 bridge, (aka Loc-3 and MCSP4)
5. MCSP5: the culvert outflow from the Main Outfall
6. MCSP2: in a grassy swale down flow from MCSP6 and the secondary outfall.

2.6 Stormwater Collection System—Soil Investigation

The work summarized below was designed to characterize soils at the prison facility for potential contaminants discharged from the stormwater collection system as well as to collect baseline data to characterize the chemical makeup of soil samples not associated with the MCSP Perimeter Ditch construction activities. During this investigation soil samples were collected in laboratory-supplied samples bottles, immediately labeled (if not pre-labeled), placed in an ice-filled cooler, and submitted to the laboratory under appropriate chain-of-custody for analyses of one or more of the constituents shown in Tables 2.6-1 through 2.6-6.

Table 2.6-1 Laboratory Analysis—Soil
Organics
Mule Creek State Prison, Amador County, California

Constituent	Analytical Method	Sampling Dates
Total Petroleum Hydrocarbons as Diesel	EPA[1] 8015DRO	3/28/18, 4/27/18
Total Petroleum Hydrocarbons as Motor Oil	EPA 8015DRO	3/28/18, 4/27/18
Volatile organic compounds	EPA 8260B	6/12/18, 6/13/18
Semi-volatile organic compounds	EPA 8270C	6/12/18, 6/13/18

1. EPA: U.S. Environmental Protection Agency

Table 2.6-2 Laboratory Analysis—Soil
Microbial
Mule Creek State Prison, Amador County, California

Constituent	Analytical Method	Sampling Dates
Fecal Coliforms	SM[1] 9221B,E	3/28/18, 4/27/18
Total Coliforms[2]	SM 9221B,C	3/28/18, 4/27/18
Human Fecal	Human Bacterioidetes ID: Dorei or EPA	4/27/18, 6/13/18
Bird Fecal	Bird Fecal ID	4/27/18, 6/13/18

1. SM: Standard Method
2. Using a minimum of 15 tubes or three dilutions

Table 2.6-3 Laboratory Analysis—Soil
General Chemistry
Mule Creek State Prison, Amador County, California

Constituent	Analytical Method	Sampling Dates
Ammonia as N	SM[1]4500NH3C	3/28/18, 4/27/18, 6/12/18
Chloride	EPA[2] 300.0	3/28/18, 4/27/18, 6/12/18
Nitrate as N	EPA 300.0	3/28/18, 4/27/18, 6/12/18
Total Kjeldahl Nitrogen	SM4500-Norg B	3/28/18, 4/27/18, 6/12/18
Total Suspended Solids	SM 2540D	4/27/2018
Phosphorus	EPA 6010B	4/27/18, 6/12/18
Potassium	EPA 6010B	6/12/2018

1. SM: Standard Method
2. EPA: U.S. Environmental Protection Agency

Table 2.6-4 Laboratory Analysis—Soil
Total Metals
Mule Creek State Prison, Amador County, California

Constituent	Analytical Method	Sampling Dates
Aluminum	EPA[1] 6010B	3/28/18, 4/27/18, 6/12/18
Antimony	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Arsenic	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Barium	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Beryllium	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Cadmium	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Chromium	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Cobalt	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Copper	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Iron	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Lead	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Mercury	EPA 7470A	3/28/18, 4/27/18, 6/12/18
Molybdenum	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Nickel	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Selenium	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Silver	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Sodium	EPA 6010B	4/27/18, 6/12/18
Thallium	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Vanadium	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Zinc	EPA 6010B	3/28/18, 4/27/18, 6/12/18

1. EPA: U.S. Environmental Protection Agency

Table 2.6-5 **Laboratory Analysis—Soil**
Toxicity Characteristic Leaching Procedure (TCLP) Soluble Metals
Mule Creek State Prison, Amador County, California

Constituent	Analytical Method	Sampling Dates
Aluminum	EPA[1] 6010B	3/28/18, 6/12/18
Antimony	EPA 6010B	3/28/18, 6/12/18
Arsenic	EPA 6010B	3/28/18, 6/12/18
Barium	EPA 6010B	3/28/18, 6/12/18
Beryllium	EPA 6010B	3/28/18, 6/12/18
Cadmium	EPA 6010B	3/28/18, 6/12/18
Chromium	EPA 6010B	3/28/18, 6/12/18
Cobalt	EPA 6010B	3/28/18, 6/12/18
Copper	EPA 6010B	3/28/18, 6/12/18
Iron	EPA 6010B	3/28/18, 6/12/18
Lead	EPA 6010B	3/28/18, 6/12/18
Mercury	EPA 7470A	3/28/18, 6/12/18
Molybdenum	EPA 6010B	3/28/18, 6/12/18
Nickel	EPA 6010B	3/28/18, 6/12/18
Selenium	EPA 6010B	3/28/18, 6/12/18
Silver	EPA 6010B	3/28/18, 6/12/18
Thallium	EPA 6010B	3/28/18, 6/12/18
Vanadium	EPA 6010B	3/28/18, 6/12/18
Zinc	EPA 6010B	3/28/18, 6/12/18

1. EPA: U.S. Environmental Protection Agency

Table 2.6-6 Laboratory Analysis—Soil
Waste Extraction Test Using De-Ionized Water (DI-WET) Soluble Metals
Creek State Prison, Amador County, California

Constituent	Analytical Method	Sampling Dates
Aluminum	EPA[1] 6010B	3/28/18, 4/27/18, 6/12/18
Antimony	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Arsenic	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Barium	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Beryllium	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Cadmium	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Chromium	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Cobalt	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Copper	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Iron	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Lead	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Mercury	EPA 7470A	3/28/18, 4/27/18, 6/12/18
Molybdenum	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Nickel	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Selenium	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Silver	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Thallium	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Vanadium	EPA 6010B	3/28/18, 4/27/18, 6/12/18
Zinc	EPA 6010B	3/28/18, 4/27/18, 6/12/18

1. EPA: U.S. Environmental Protection Agency

2.6.1 Soil Sampling

The following soil samples were collected and analyzed in general accordance with the Order; the March 15, 2018, stormwater collection system investigation work plan; and the March 23, 2018, CVRWQCB Conditional Approval. Additionally, as an expanded investigation, soil samples were collected to augment the data set to gain a better understanding of the site conditions. Samples were collected in various locations at the facility including, but not limited to, the northern property boundary of the prison, the WWTP, the banks of Mule Creek, soil stockpile areas, and the Perimeter Ditch.

In accordance with the March 2018 stormwater collection system investigation work plan, soils excavated from the MCSP Culvert Installation Project were evaluated for potential wastewater contamination. At the time that the work plan was prepared, SHN estimated a soil stockpile volume of approximately 5,100 cubic yards, based on information from MCSP personnel. However, based on observations of the stockpile by SHN personnel, the volume of soil generated from the culvert installation was recalculated. The original estimate of soil also included material that was generated during the 2015 MCIC prison expansion. The two sources of soil were distinguishable by vegetative cover. The culvert installation stockpile had essentially no vegetative cover. SHN personnel estimated that approximately 850 cubic yards of the stockpiled material was from the culvert installation.

2.6.1.1 Stockpile Sampling

On March 29, 2018, SHN personnel collected four, 4-point composite samples (SP-1 through SP-4) to characterize the soil excavated during construction of the MCSP Culvert Installation Project. The 4-point composite samples were collected at the frequency of approximately one 4-point composite for every 250 cubic yards of the stockpiled soil. For each composite sample, four discrete samples were collected into 4-ounce glass jars in the field. Discrete samples were collected between 12 and 18 inches below the top of the stockpile. The approximate locations of the composite samples are shown in Figure 1-9.

On June 13, 2018, SHN collected ten 4-point composite soil samples (SP-5 through SP-14) from the large stockpile associated with the 2015 MCIC prison expansion. The 4-point composite samples were collected at the frequency of approximately one 4-point composite for every 500 cubic yards of the stockpiled soil. For each composite sample, four discrete samples were collected into 4-ounce glass jars in the field. Discrete samples were collected approximately 3 inches below the top of the stockpile. The locations of the composite samples are shown in Figure 1-9.

The composite soil samples were labeled, placed in an iced cooler, and shipped to the analytical laboratory, under chain-of-custody documentation, and analyzed for the constituents listed in Tables 2.6-1 through 2.6-6. SHN directed the laboratory to analyze five composite samples (SP-6, SP-8, SP-11, SP-12, and SP-14) and to hold the five remaining composite samples, pending the results of the analysis. Two of the five stockpile samples (SP-12 and SP-14) analyzed were from the borrow area of the MCIC stockpile (Figure 1-9).

2.6.1.2 Perimeter Ditch Sampling

On March 28 and 29, 2018, surface soil samples were collected in the Perimeter Ditch at GT-3, the Main Outfall, between the Main Outfall and GT-2, GT-4, and GT-9 in order to determine if the surface soils in the Perimeter Ditch have been impacted by any potential wastewater. The locations of the soil samples are shown in Figure 1-10.

On June 13, 2018, in response to the CVRWQCB's letter (dated May 24, 2018), SHN collected nine soil samples in the Perimeter Ditch approximately midway between each guard tower (labeled "GT-#"; Figure 1-11).

Composite and Perimeter Ditch soil samples were collected in laboratory-supplied 8-ounce glass jars, labeled, placed in an ice cooler, and shipped to the analytical laboratory under chain-of-custody documentation and analyzed for the constituents listed in Tables 2.6-1 through 2.6-6.

2.6.1.3 Baseline Sampling

On April 27, 2018, SHN collected 5 baseline soil samples (labeled "BS") from the site for comparison to soil samples collected from the culvert installation soil stockpile and the Perimeter Ditch as well as for MST. Sampling locations were chosen to represent differing soil types, according to the USDA National Resources Conservation Service (NRCS) soils map and United State Geologic Survey (USGS) preliminary geologic maps of the area. Additionally, baseline soil sample locations were chosen in locations that were not in close proximity to wastewater treatment spray fields. Sample locations are shown on Figure 1-12.

Baseline soil samples were collected in laboratory-supplied 16-ounce glass jars and in new 4-ounce Nasco Whirl-Pak® plastic bags, labeled, placed in an iced cooler, and shipped to the analytical laboratory under chain-of-custody documentation and analyzed for one or more of the constituents listed in Tables 2.6-1 through 2.6-14.

2.6.1.4 CVRWQCB Split Sampling

On June 12, 2018, SHN also collected five split soil samples for MST analysis from similar locations that CVRWQCB staff collected soil samples. The samples collected by SHN for MST analysis were in lieu of coliform analysis.

Soil samples submitted for MST analysis were collected in new, Zip-lock® bags labeled, placed in an iced cooler, and shipped to the analytical laboratory under chain-of-custody documentation and analyzed for the constituents listed in Table 2.6-2.

2.7 Sampling Equipment Decontamination Procedures

Re-useable sampling equipment (including polyvinyl chloride [PVC] extension pipe and sample containers) was first washed in an Alconox® and distilled water solution followed by a distilled water rinse. The equipment was given a final rinse with distilled water and allowed to dry prior to re-use. Decontamination water was placed into 5-gallon buckets for disposal via the facility's wastewater collection system. No decontamination was necessary for new, disposable sampling equipment.

3.0 Site Investigation Results

This section summarizes the results of the investigation activities. The data collected from the 2019 efforts support what was observed in the original 2018 report. The bulk of the data collected since August 2018 has primarily been the expanded CCTV investigation work and surface water sampling collected primarily from the main and secondary outfalls.

3.1 Stormwater and Sanitary Sewer Collection Systems Survey and Mapping Review

The survey of the stormwater and sanitary sewer collection systems included location, invert elevations, rim elevations, and pipe diameters for all of the structures surveyed. The updated survey drawing is included in Appendix 8. Tables containing inlets, outlets, and structure and rim elevations for the stormwater and the sanitary sewer collection systems located in the Center Corridor and along the Interior Perimeter Road are included in Appendix 8, Tables 8-1 through 8-4. The following sections discuss the physical separation between the stormwater and sanitary sewer collection systems lines and their location in relation to each system.

3.1.1 Center Corridor Survey Review

The stormwater and sanitary sewer collection systems are co-located along the A/B and B/C Center Corridor, and along the outside perimeter of Facilities "A," B, and C (Figure 1-6). The bulk of the stormwater collection system within the Center Corridor is located at a lower elevation than the sanitary sewer, with the exception of the stormwater line sections from SWMH-514 to SWMH-511, and 90 feet out of the 135 feet from SWMH-501 to DI-A1, which are located at a lower elevation than the sanitary sewer system (Figure 1-13).

The sanitary sewer line on the west side of the A/B corridor (SSMH-403 to SSMH-13) maintains a horizontal separation of approximately 10 feet and a vertical separation from approximately 10 feet above to 7 feet below the stormwater collection line.

On the east side of the A/B Corridor, the sanitary sewer line (SSMH-109 to SSMH-105) was originally installed with a horizontal separation of 30 feet from the stormwater collection line; however, in August 2015, a new pharmacy building was constructed, necessitating a realignment of the stormwater collection system around the pharmacy building, which brought the lines to within approximately 4 to 8 feet of each other for approximately 100 feet between stormwater manholes SWMH-507A and SWMH-507B. Additionally, the stormwater collection alignment at SWMH-507 is approximately 11 feet horizontally from the sanitary sewer alignment.

The vertical separation between the stormwater collection and sanitary sewer lines ranges from approximately 4 feet at SSMH-109 to less than 1 foot at SSMH-105, with an average of 2 feet of vertical separation in the segment between SWMH-507A and SWMH-507B due to the pharmacy building realignment. These sanitary sewer segments are all located at a higher elevation compared with the stormwater collection line.

SSMH-105 is a wye-junction with the sewer line exiting the Center Corridor towards SSMH-104 to the south. SSMH-105 collects approximately one-third of the A/B Corridor to the west and approximately one-half of the B/C Corridor to the east. The sanitary sewer line south parallels a stormwater collection section running from DI-D50 to SWMH-507 (Appendix 8). At DI-D100, the horizontal separation is at a minimum of 12 feet. The stormwater lines diverge away from the sanitary sewer downstream and upsteam of DI-D100 with horizontal separations in excess of 24 feet for the remainder of the parallel section. There is one crossing of the stormwater collection and sanitary sewer mains approximately 11 feet south of SWMH-507. The vertical separation of the lines at the crossing is within 1 foot, with the stormwater collection line likely underneath the sanitary sewer because invert elevations at the crossings are nearly identical. We cannot be certain which is above; however, as explained below in Sections 3.4.1.2 and 3.4.2.3 there were no defects found near the crossing. The sanitary sewer line from SSMH-105 to SSMH-104 is lower than the stormwater line that parallels it by approximately 1 to 4 feet.

The sanitary sewer lines on the south east end of the B/C corridor (SSMH-105 to SSMH-107) were originally installed with a 25-foot horizontal separation from the stormwater collection lines; however, a realignment between SSMH-106B and SSMH-106 has brought the lines to within 8 feet horizontally of each other at SSMH-106A, as a result of construction of a new freezer building in 2015. The vertical separation between the stormwater collection line and sanitary sewer ranges from approximately 0.3 feet to 1.2 feet below the sanitary sewer line between the SSMH-105 to SSMH-107 segment. In this segment, the sanitary sewer line is at a higher elevation compared with the stormwater collection line. The remainder of this section maintains a horizontal separation of 25 feet.

The sanitary sewer lines on the north east end of the B/C corridor (SSMH-210 to SSMH-207) were originally installed with a horizontal separation of approximately 7 feet. The CCTV inspection of the sanitary sewer line between SSMH-210 and SSMH-209 indicates that bends were installed in the line, bringing it to within 1 to 2 feet of the stormwater collection line for an approximate 50-foot section. These bends are located at grease traps (believed to have been installed in 1990) near the meat plant. The vertical separation between the stormwater collection lines and sanitary sewer lines begins at SSMH-210 with the sanitary sewer less than 1 foot above the stormwater collection and then sewer slopes steadily to 6 feet below the stormwater collection lines at SSMH-207. After SSMH-207, the sanitary sewer line diverges south to SSMH-205.

The sanitary sewer line from SSMH-208 to SSMH-205 is not parallel to the stormwater collection line; however, there is a crossing close to SSMH-208. The furthest upstream stormwater collection manhole,

SWMH-514, could not be accessed in the field; therefore, the original design plans were used to estimate location, alignment, and elevations. This manhole is located within the Sally Port and is not physically accessible for security concerns. The location is approximate from the original design plans and distance measured from CCTV inspection. From these estimates, the stormwater collection line appears to be at a higher elevation at the crossing; however, the vertical separation is likely less than a foot.

3.1.2 Perimeter Stormwater Collection System Survey Review

3.1.2.1 2018 Survey

The perimeter stormwater collection system was surveyed in conjunction with the perimeter sanitary sewer manholes on the week of July 23, 2018 (see Figure 1-14). The sanitary sewer manholes around the perimeter encircle the facility inside of the LEF, maintaining a horizontal separation of 65 feet or greater from the exterior Perimeter Ditch collection system. However, there appears to be multiple sanitary sewer line crossings near the stormwater collection system connections to the Perimeter Ditch. The survey data indicates that the sanitary sewer invert elevations are lower than the calculated stormwater inverts at the crossing locations. Figures 1-15 through 1-17 include the profiles of the sanitary sewer system along the perimeter with elevations of the crossing stormwater collection system lines. Appendix 2, Table 2-3 shows the calculated vertical separations at the crossings along the perimeter. Throughout the entire perimeter, the sanitary sewer lines are below the crossing stormwater collection system lines with vertical separations ranging from 1.6 feet to 12.1 feet.

Sewer lateral crossings for housing units are estimated to be above the stormwater collection system at crossing locations. Building laterals are typically shallow as they are laid down before the building slab. However, some turn downwards to meet up with the sanitary sewer main close to the building, while others do so further out.

Laterals are not exposed and do not have survey-able alignments; therefore, they are not shown on the profile drawings.

3.1.2.2 2019 Survey

Additional structures identified as a result of this expanded investigation are to be surveyed this fall. Results from this survey effort will be submitted to the CVRWQCB in the spring of 2020.

3.1.3 Perimeter Sanitary Sewer Survey Review

3.1.3.1 2018 Survey

As discussed in the previous section, the stormwater collection system exits the “A,” B, C, and D yards and connects to the Perimeter Ditch stormwater collection system (Figure 1-14). As it does so, the stormwater lines are located above the sanitary sewer system around the Interior Perimeter Road. In addition to these crossings, there are three segments around the Interior Perimeter Road where the stormwater and sanitary sewer lines run parallel to each other. These segments are from SSMH-22 to SSMH-6, from SSMH-201 to SSMH-202, and in the vicinity of SSMH-101.

The parallel section between SSMH-22 and SSMH-6 is approximately 310 feet long with the horizontal separation between the lines ranging from 14 feet to 20 feet. At SSMH-22, the sanitary sewer line is approximately 1 foot higher in elevation compared with the stormwater line and at SSMH-6 the sanitary sewer line is approximately 7 feet lower than the stormwater line. The sanitary sewer line is at a higher elevation than the stormwater line for approximately 150 feet (Figure 1-16).

Between SSMH-201 and SSMH-202, an infill building was constructed in 2015 as part of the MCSP Health Care Facility Improvement Program (HCFIP) project. Construction of this building included a realignment of the sanitary sewer and the addition of stormwater lines. In this project, two new stormwater manholes and two new sanitary sewer manholes were added bringing the stormwater and sanitary sewer parallel for approximately 160 feet. In this parallel section, the horizontal separation ranges from 2 feet to 4 feet with the sanitary sewer line 3 feet to 4 feet lower than the stormwater line (Figure 1-17).

The sanitary sewer and stormwater collection systems are also parallel for a 90 foot segment near SSMH-101. In this segment, the horizontal separation ranges from 19 feet to 36 feet with the sanitary sewer line 3 feet to 6 feet lower than the stormwater lines (Figure 1-17).

As mentioned in the previous section, sewer lateral crossings for housing units are buried and, therefore, were not surveyed. The sewer laterals are estimated to be above the stormwater collection system at crossing locations.

3.1.3.2 2019 Survey

Additional structures identified during the expanded investigation will be surveyed fall of 2019. Results will be submitted in the spring of 2020.

3.2 Maintenance Logs

3.2.1 Maintenance Logs

Stormwater collection system maintenance in the Center Corridor includes jetting (which is the use of a high-pressure water jet to clear obstructions within a pipeline) and unplugging the main lines. Maintenance logs are presented in Appendix 9.

An independent review of the facility identified what was incorrectly referred to as a wash pad (located at the landscape maintenance lay-down area) that was discharging to the stormwater collection system. The review recommended re-plumbing the wash pad to the sanitary sewer, and that was accomplished on November 3, 2017. This investigation identified the wash-down activity to be the problem, not the plumbing. To mitigate this activity, MCSP discontinued wash-down activities at this location on July 6, 2018, by capping the line and disconnecting the water supply.

There is no record of maintenance activity to repair breaks in the stormwater collection system.

Sanitary sewer system collection mains have been occasionally plugged with trash and debris requiring jetting and auguring to clear the blockages. The B/C Center Corridor is subject to more maintenance requests compared with the A/B Center Corridor area. Maintenance logs indicate that the B/C Center Corridor has had three instances of sanitary line breakages and subsequent repairs: two in April 2014 and one in January 2015.

3.2.2 Maintenance Logs Update: Summer 2018–Fall 2019

Over the past year, maintenance logs include plugging the storm drain discharge for the GT-2 Drainage Basin, repairs to the irrigation system, permanent closure of GT-2 outfall, installation of a flow meter to monitor irrigation flows, maintenance on the transfer pumps currently located at GT-3 and GT-9 to transfer

water collected in the Perimeter Ditch into the sanitary sewer, and installation of the flow meters in the culverts that discharge to the main and secondary outfall swales.

3.3 Timeline of Changes

MCSP has reported flooring failures attributed to groundwater infiltration. For example, in 2004, MCSP staff discovered water transmission through the concrete floor slab in the CTC. During construction, soil was excavated and replaced with engineered fill to provide stable grades for construction. Rainfall, irrigation runoff, and other water sources collect under the building and transmit through the floor slab. Dewatering systems have been installed at this building to prevent groundwater infiltration. In June 2016, French drains and sump pumps were installed at the CTC and plumbed to the stormwater collection system, which provides a source of groundwater in the stormwater collection system.

Recent facility operational changes that affect non-stormwater discharges to the stormwater collection system have occurred primarily in the Center Corridor, and include:

- facility-wide memoranda, prohibiting the washing down of paved areas and other illicit discharges into the stormwater collection system (Appendix 19);
- permanent shut-down of the hydronic system, which provided hot water to the entire facility, on April 13, 2018; and
- operational changes to the irrigation system in 2019, which included shut off flow to irrigation loop when not in use.

3.3.1 Maintenance Logs

This information was gathered by interviewing MCSP facility staff and reviewing site plans. A summary of the timeline of changes is presented in Appendix 10.

- The changes included grease traps near the meat packing facility (which are believed to have been installed in 1990) which rerouted the sanitary sewer line between SSMH-210 and SSMH-209.
- In 2009, freezers were installed at the CTC building, the condensate lines were plumbed to discharge into the stormwater collection system in the Center Corridor.
- In 2014, the French drain installation groundwater and dewatering at the CTC site, was plumbed into the stormwater collection system in the Center Corridor.
- In 2015, redirection of the stormwater line between SWMH-506 and SWMH-507 in the A/B Center Corridor with construction of the new Pharmacy building.
- In 2015, refrigeration units near SSMH-106 were installed, which required the sanitary sewer line to be rerouted from SSMH-106 to SSMH-106A and SSMH-106B, and the condensate lines were plumbed to the stormwater collection system.
- In 2016, four sumps were installed in the lightwell courtyard of the CTC building, and plumbed into the stormwater DI located in the courtyard.
- In 2016, three clothing exchanges were installed, one per yard. Construction of these structures resulted in additional stormwater DIs, which discharge to the Perimeter Ditch.
- In 2016, a medical clinic in C yard was constructed, with stormwater lines discharging into the Perimeter Ditch.
- In February 2018, storm drain discharge to GT-2 drainage basin was temporarily blocked.

- As of April 13, 2018, MCSP abandoned the hydronic loop system, which provided hot water to the whole facility for heating.
- In May 2019 MCSP installed a landscape irrigation flow meter.
- Modified discharge culverts at Main and Secondary Outfalls.

3.3.2 Maintenance Logs Update: Summer 2018–Fall 2019

- Repair underground leak headed near storm drain in vicinity of housing unit Y5.
- GT-2 drainage basin was incorporated into the Main Outfall drainage basin in December 2018.
- GT-2 outlet was permanently blocked on December 15, 2018.
- Water flow to the irrigation loop is now shut off when not in use.
- Repaired leak in irrigation system near visitor processing on February 3, 2018.
- Repaired pump at GT-2 on June 29, 2018.
- Installed water meter on pump at GT-2 and GT-4 on August 22, 2018.
- Repaired leak in irrigation system near southwest parking lot on August 22, 2019.
- Hardwire flow meters on pumps at GT-2, GT-3, and GT-9 on September 18, 2018.
- Repair irrigation leak in the off-limits area near Y-2 on September 21-22, 2018.
- Repaired leak in irrigation system near building Y-11 on October 11, 2018.
- Repaired leak in irrigation system near GT-3 on November 1, 2018.
- Run power to irrigation pump 3, December 21, 2018.
- Run power to and install new flowmeters at Main Outfall culverts on March 27-28, 2019.
- Install flow meter on main irrigation line on April 5, 2019.
- Install flow meter at GT-3 on April 19, 2019.
- Repaired leak in irrigation system near building Y-1 on July 27, 2019.
- Repaired leak in irrigation system near building Y-11 on August 8, 2019.
- Repaired leak in irrigation system on August 19, 2019.
- Repaired leak in irrigation system near building Y-3 on August 22, 2019.
- Repaired leak in irrigation system near building Y-6 on August 23, 2019.
- Repaired leak in irrigation system near building Y-11 on August 31, 2019.
- Repaired leak in irrigation system along interior perimeter road on August 22-23, 2019.
- Repaired leak in irrigation system on August 27, 2019.
- Repaired leak in irrigation system near building Y-2 on September 21, 2019.
- Repaired leak in irrigation system near GT-2 on September 21, 2019.
- Repaired leak in irrigation system near building Y-5 on September 21, 2019.
- Install flow meters at secondary outfall on September 27, 2019.
- Repaired leak in irrigation system near building Y-3 on September 27, 2019.

3.4 Stormwater Collection and Sanitary Sewer Collection Systems Physical Assessments

The physical assessment of the stormwater collection system within the Center Corridor area consisted of manhole inspection and CCTV inspection. The sanitary sewer collection system physical assessment within the Center Corridor area consisted of manhole inspection, CCTV inspection, dye testing, and smoke testing. Field notes are included in Appendix 12. The following sections summarize the results of these activities.

3.4.1 Stormwater Collection System Physical Assessment

The stormwater collection system assessment was limited to manhole inspection and CCTV inspection. In 2018, the initial investigation addressed approximately 16% of the overall system, and the subsequent investigation in 2019 addressed the remainder.

3.4.1.1 Manhole Inspections

All of the stormwater collection manholes inspected in the Center Corridor appear to be in good structural condition with no apparent risk of structural failure. A typical manhole detail is presented on Figure 1-18. However, most of the manholes were identified to have relevant defects such as poor joint, grade ring, and lateral connection seals. These defects may allow water in the surrounding soil to infiltrate into the structures. Encrusted debris in several of the channels and lack of formed benches in others present challenges for maintenance but are not relevant to infiltration. Appendix 2, Table 2-4 summarizes the relevant defects for the stormwater manholes. Completed inspection forms are included in Appendix 13.

3.4.1.2 CCTV Inspection

3.4.1.2 (i) 2018 (Phase I)

In 2018, approximately 4,622 lineal feet of the stormwater collection system was inspected, primarily in the Center Corridor. The stormwater collection system through the Center Corridor had substantial accumulations of gravel and debris up to 60% of the pipe diameter. The debris required substantial effort to remove during the inspection processes through high pressure water jetting. Tracking of gravel from around the site through the Center Corridor is the likely source of the particulate debris; however, encrusted concrete waste was also present in the manhole channels, particularly in the B/C corridor. This encrusted waste appears to be from the original construction. The encrusted concrete waste prevented the CCTV transporter from passing through several of the manholes; therefore, reverse surveys were completed as necessary.

Review of the stormwater collection system CCTV footage revealed that a 4-foot section between SWMH-509 and SWMH-510 was installed with a slotted crown to perform as a French drain. CCTV logs of this segment showed that groundwater was actively dripping in.

Review of the stormwater collection system CCTV footage and reports also identified defects relevant to infiltration. Relevant defects include joint separations, defective lateral seals, infiltration staining, bulging pipe (pipe wall deformed inwards), and cracks. Additional defects not relevant to infiltration include encrusted debris, sags, cross-sectional deformities, and surface cracks. DI connections were also inspected by CCTV at the loading docks for the “A” and B kitchens, and at the loading dock for the coffee plant. Appendix 14 includes the CCTV logs for the inspection. Appendix 15 includes figures that illustrate the results of the CCTV findings.

The pipe material from DI A1 to SWMH-506 and between SWMH-507C and SWMH-507 is reinforced concrete pipe (RCP) with surface cracking characteristic of concrete structures. None of the cracks were separated and open; therefore, they are not categorized as fractures.

The pipe material between SWMH-506 and SWMH-507C and between SWMH-507 and SWMH-514 is PVC with no surface cracking evident. Infiltration staining between SWMH-506 and SWMH-513 is located at joints with several identified as separated. Only two lateral connections in the stormwater collection system occurred in the mainline and both of them appeared to be poorly sealed.

Bulges where the pipe wall was deformed inwards were noted in three locations. These bulges are likely caused by proximity to the former hot water hydronic loop; however, none of the bulges created holes or cracks in the pipe wall.

3.4.1.2 (ii) 2019 (Phase II)

A total of 20,252 lineal feet of the stormwater collection system was inspected in 2019. The majority of major defects observed were due to joint connection problems such as offset or separated joints, intruding gaskets or poor seals. The next most common major defect was due to broken or collapsed pipes or holes within the pipe. The remaining observed major defects were due to deformities, repairs and infiltration issues, root intrusion, corrosion, cracked pipes, and pipes with blockages and/or deposits. CCTV logs and correction tables that address segment names and segment types that were mislabeled in the field are presented in Appendix 14. Appendix 15, Table 15-1 lists findings for the stormwater collection system.

The majority of major stormwater collection system defects encountered in 2019 were observed in "A" Yard, C Yard, and the undeveloped land outside of the Exterior Perimeter Road in roughly equal proportions. To a lesser extent, stormwater defects were observed in the off-limits area of the "A" Yard, and in the B and C yards. A minimal proportion of defects were observed in remaining areas (Warehouse, Center Corridor A/B and B/C, B Yard, and the off-limits area in D Yard). Figures in Appendix 15 depict the locations of findings in the stormwater collection system.

Active infiltration was observed at eight storm drain segments. Three observations of active infiltration were observed in the off-limits area of D Yard and one each in Center Corridor A/B and B/C, C Yard, the Warehouse, and undeveloped land outside of the Exterior Perimeter Road.

A total of 176 lineal feet of defected line was observed in 2019 in the stormwater collection system. A majority was continuous [minor] corrosion in the parallel Main Outfall culverts. Linear deformities were also observed in "A" Yard, C Yard, and the undeveloped land outside of the Exterior Perimeter Road.

A total of 17,480 lineal feet of stormwater line was inspected in 2019.

3.4.2 Sanitary Sewer System Physical Assessment

The physical assessment of the sanitary sewer collection system within the Center Corridor area included dye testing, smoke testing, manhole inspections, and CCTV inspections. In 2019, CCTV inspections were expanded throughout the facility. However, a small portion of sanitary sewer line was not inspected due to it being located downgradient and outside of the MCSP Perimeter Ditch and/or the need to perform bypass pumping to facilitate inspection. The following sections summarize the results of these activities.

3.4.2.1 Dye Testing

During the dye testing conducted on January 8, 2018, MCSP staff did not observe any dye in the stormwater collection system; however, MCSP staff did observe dye at the wastewater facility. Dye from the second test, which focused on the loading dock at the meat packing plant and main kitchen (conducted on April 19, 2018), was observed entering the sanitary sewer manhole SSMH-210, confirming the sanitary sewer connection to the meat packing plant and main kitchen loading dock DIs. Dye test results found no evidence that cross connections between the stormwater and sanitary sewer collection systems exist, and indicate that the sanitary sewer system is plumbed correctly. A map of the dye testing areas is included in Appendix 16.

3.4.2.2 Manhole Inspections

The sanitary sewer manholes within the Center Corridor were found to be in good structural condition with no risk of structural failure. The relevant defects identified were poorly sealed joints and lateral connections, and corrosion of the benches. Depending upon the groundwater level, these defects may allow water to infiltrate into the structure or exfiltrate into the surrounding soil. Appendix 2, Table 2-6 summarizes the relevant defects for the sanitary sewer manholes. Appendix 13 includes the completed manhole inspection forms.

In summary, the majority of the manholes have good structural integrity with no broken wall or cone segments. Several grade rings have gaps that could be grouted for better sealing. Corrosion was observed with aggregate visible on the benches of four of the sanitary sewer manholes. "Broken-in" (that is, manhole modified in place to install pipe) lateral connections with poor sealing were present in several of the manholes as well. Finally, many of the wall joints in the manholes did not appear to be fully sealed.

3.4.2.3 CCTV Inspections

3.4.2.3 (i) 2018

In 2018, approximately 3,441 lineal feet of sanitary sewer mainline CCTV inspections were completed in the Center Corridor area, along with inspections of the laterals crossing the stormwater collection system. Due to inaccessible bends in the line between sanitary sewer SSMH-210 and SSMH-209, and deformities in the line between sanitary sewer SSMH-209 and SSMH-207, the full length of the pipe could not be inspected by CCTV.

Review of the sanitary sewer system mainline CCTV footage and reports was completed to identify defects relevant to exfiltration (see Appendices 14 and 15). These relevant defects included joint separations and offsets, defective lateral seals, infiltration staining, exposed gaskets, and bulging/deformed pipe. Additional defects included encrusted concrete debris, sags, and cross-sectional deformities. Appendix 14 includes the CCTV logs for the inspection.

Findings in the sanitary sewer lateral inspections are included in Appendix 15. The relevant defects include joint separations and offsets, and bulges in the pipe wall. Other defects noted in the CCTV reports include sags and cross-sectional deformities. Some laterals could not be fully inspected to the building connection due to p-traps, lateral deformities, or mainline deformities which prohibited lateral launching. The DI connection at the loading dock for the meat packing facility was also inspected with CCTV.

3.4.2.3 (ii) 2019

A total of 31,880 lineal feet of sanitary sewer main, laterals, and grease waste lines were inspected in 2019. Approximately half of those major defects were due to joint connection problems such as offset or

separated joints, intruding gaskets, or poor seals. The next most common major defect was due to corrosion within the pipe. Additional major defects were due to deformities, broken or collapsed pipes, and the remainder of defects (cracks, infiltration, deposits and repairs) were all less than 5% of the total observed major defects. CCTV logs and correction tables that address segment names and segment types that were mislabeled in the field are presented in Appendix 14. Appendix 15 contains all of the noted major findings for the sanitary sewer collection system (including grease waste lines).

Approximately 40% of the major findings encountered in the sanitary sewer collection system were observed in the Center Corridor areas. The remaining sanitary sewer findings were observed throughout the facility.

Active infiltration was observed within the sanitary sewer collection system in three lines. One location was in a grease waste line and another within a sanitary sewer line within the Center Corridor B/C area. The third observation was in the off-limits area of B Yard.

The majority of findings observed in the grease waste and sanitary sewer lines were due to corrosion. The remainder was due to deformities and intruding gaskets.

Corrosion within the sanitary sewer collection system, while prevalent, ranged from minor to moderate. The pipe inverts appeared intact in every inspection and flow was not significantly restricted in those areas.

A total of 29,210 feet of sanitary sewer lines was inspected in 2019.

3.4.2.4 Smoke Testing

Smoke testing was performed in the sanitary sewer system to aid in identifying any cross connections between the stormwater and sanitary sewer collection systems. An overview of the smoke testing area and details of the return defects are included in Figures 1-25 through 1-27. Completed smoke testing forms are included in Appendix 17.

Smoke was observed exiting a seam in the concrete between sanitary sewer manhole SSMH-210 and stormwater manhole SWMH-510. Smoke also passed through gaps in the grade rings (see Figure 1-18), located at the top of SWMH-510; however, no smoke was observed exiting the stormwater collection main or laterals into SWMH-510. Smoke returns observed in gaps in manhole grade rings indicate that the grade rings are poorly sealed. Grade rings are located just below the manhole cover and are typically above the water table. Smoke also returned through concrete seams around sanitary sewer manholes SSMH-403, SSMH-209, SSMH-107, and SSMH-106. Returns were also observed in the grass around SSMH-108, through equipment drains in yard B4, near the edge of a grease trap outside of building C1-3, and at a pavement seam near SSMH-109. Additionally, smoke was observed exiting through cleanouts, roof vents, floor drains, and sanitary sewer manhole covers, as expected during smoke test activities.

With the exception of the grade rings at SWMH-510, no smoke returns were observed at stormwater collection mains, DIs, catch basins, gutters, or stormwater collection manholes. Therefore, smoke testing did not identify any direct connections between the stormwater and sanitary sewer collection systems.

3.4.3 Observed Facility Practices

The additional observed practices in 2018 included the following:

- Wash-down of loading docks in Center Corridor (possible use of surfactants)
- Vehicle and equipment wash downs (recycle yard)
- Dumping of mop buckets outside and/or in stormwater DIs
- Excessive irrigation water runoff
- Improper or delayed maintenance of stormwater DIs
- Construction practices that impact stormwater DIs
- Trash and debris not cleaned in timely manner (Center Corridor, Interior Perimeter, and recycle yard)
- Dumpsters leaking (Center Corridor)
- Delayed maintenance of asphalt and concrete (Center Corridor and Interior Perimeter Road)
- Use of stormwater DI at landscaping yard as a wash pad
- Non-traditional Small MS4 permit coverage since April 2019

3.5 Stormwater Collection System—Water Sampling Results

From January 25, 2018, through August 2019, over 600 water samples were collected from select locations within the prison property including Mule Creek. This includes daily sampling by MCSP staff from January 2018 to October 2018; reduced frequency sampling by MCSP staff from October 2018 to March 2019, and reduced frequency sampling by Confluence Environmental Field services from March 2019 through August 2019.

The following sections summarize water samples collected from the Main Drainage Basin; the Main Drainage Basin conveyance to Mule Creek; the Secondary Drainage Basin; the Secondary Drainage Basin conveyance to Mule Creek; upstream, midstream, and downstream locations on Mule Creek; as well as other locations within the prison property.

Various sample IDs for the same sampling location were used during this investigation. For example, GT-2 is also known as Guard Tower 2; GT-3 is also known as Guard Tower 3, Junction/Outfall, and Main Outfall; GT-4 is also known as Guard Tower 4; GT-5 is also known as Guard Tower 5; and GT-9 is also known as Guard Tower 9 and Secondary Outfall.

Various sample IDs for the three sampling locations on Mule Creek have also been used during this investigation. The northern most sampling location on Mule Creek is known as Mule Creek NP, Upstream, and MCSP1. The midstream location has been identified as Loc-1 and upstream because initially, this was the farthest upstream sampling location on Mule Creek at the time. The downstream location has been identified as Loc-3, MCDS, downstream, and MCSP4.

The following tables include the approximate number of samples collected at the location(s), number of detections, average and maximum concentrations of select constituents including petroleum hydrocarbons; volatile organic compounds; semi-volatile organic compounds; biological (total coliform, fecal coliform, and E. coli); general chemistry parameters including ammonia, biochemical oxygen demand (BOD), chemical oxygen demand (COD), methylene blue active substances (MBAS), total suspended solids (TSS), and phosphorus; select metals; and other pertinent constituents specific to a particular sampling location.

The certified analytical test results, chain of custody forms, and laboratory QA/QC for the sampling events are included in Appendix 18. The historical summary tables for the sampling events are included in Appendix 2, Tables 2-9 through 2-13.

3.5.1 Main Drainage Basin Water Sampling Results

Water samples were collected during this investigation from locations that are considered representative of the Main Drainage Basin including Center Corridor storm drain manholes; CTC building French drain; electrical and communication vaults; a sewer lift station; irrigation runoff in drop inlets; and Perimeter Ditch outfalls GT-3, GT-4, and GT-5. These water samples are representative of both stormwater and potential non-stormwater in the stormwater collection system. A site map showing these sample locations is included as Figure 1-5.

3.5.1.1 Center Corridor

On March 28 and 29, 2018 (during a dry weather period), SHN collected grab-samples from the Center Corridor manholes SWMH-502, SWMH-505, SWMH-508, and SWMH-511. These samples were collected approximately three days following a rain event, which occurred on March 25, 2018, ensuring that samples were primarily non-stormwater. During this event, samples were also collected for caffeine analysis upstream (SWMH-505) and downstream (SWMH-502*) of the coffee-roaster (Building A2). On April 27, 2018, (during dry weather), SHN collected grab samples from Center Corridor manholes SWMH-511 and SWMH-502. Table 3.5-1 summarizes select results from Center Corridor stormwater manholes within the Main Drainage Basin.

*Note: MCSP maintenance staff misidentified manhole SWMH-501 during the March 28 and 29 and April 27, 2018, sampling events; therefore, manhole SWMH-502 was inadvertently sampled instead of proposed sample location SWMH-501. Subsequently, field notes and chain-of-custody records refer to “MH-501.”

Table 3.5-1 Center Corridor (MHs[1] 501(2), 505, 508, 511) Results January 2018 to August 2019 Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[2] unless noted)				
Petroleum	5	0	--[3]	--
VOCs[4] (ug/L)				
Dichlorodifluoromethane	5	2	3.1	5.5
Trichlorofluoromethane	5	1	1.1	1.1
SVOCs[5] (ug/L)				
SVOCs	5	0	--	--
Microbial (MPN/100ml)[6]				
Fecal Coliform	6	6	26	70
Total Coliform	6	6	1,260	>1,600[7]
E. Coli	6	5	323	1,553
General Chemistry (mg/L[8] unless noted)				
Ammonia	6	0	--	--
BOD[9]	6	1	13	13
COD[10]	2	0	--	--
MBAS[11]	6	1	0.099	0.099
TSS[12]	6	4	62	230
Phosphorus	6	6	0.12	0.22
Metals (ug/L)				
Aluminum	2	1	230	230
Iron	2	2	500	800
Magnesium	2	2	22,500	27,000
Zinc	2	2	65	81
Other (mg/L)				
Caffeine	2	2	150	230

1. MH: manhole
2. ug/L: micrograms per liter
3. --: not applicable
4. VOC: volatile organic compound
5. SVOC: semi-volatile organic compound
6. MPN/100ml: most probable per 100 milliliters
7. >: greater than
8. mg/L: milligrams per liter
9. BOD: biochemical oxygen demand
10. COD: chemical oxygen demand
11. MBAS: methylene blue active substances
12. TSS: total suspended solids

3.5.1.2 CTC Building French Drain

On May 3, 2018, MCSP staff collected grab samples in the open area of the CTC building off of the B Yard and B/C Center Corridor, which is the open courtyard that the sumps for the CTC building drain, and discharges into the stormwater collection system (Figure 1-2). These samples were collected approximately 17 days following a rain event, which occurred on April 16, 2018. Table 3.5-2 summarizes the sample results from CTC Building French drain within the Main Drainage Basin.

Table 3.5-2 CTC[1] Building French Drain Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[2] unless noted)				
Petroleum	1	0	--[3]	--
VOCs[4] (ug/L)				
VOCs	1	0	--	--
Microbial (MPN/100ml)[5]				
Fecal Coliform	1	0	<1.8[6]	<1.8
Total Coliform	1	1	17	17
E. Coli	1	0	<1.0	<1.0
General Chemistry (mg/L[7] unless noted)				
Ammonia	1	0	<0.20	<0.20
BOD[8]	1	0	<5.0	<5.0
COD[9]	1	0	<50	<50
MBAS[10]	1	0	<0.50	<0.50
TSS[11]	1	1	9.8	9.8
Phosphorus	1	1	0.079	0.079
Metals (ug/L)				
Aluminum	1	1	51	51
Iron	1	1	650	650
Magnesium	1	1	13,000	13,000
Zinc	1	0	--	--

1. CTC: Correction Treatment Center
2. ug/L: micrograms per liter
3. --: not applicable
4. VOC: volatile organic compound
5. MPN/100ml: most probably number per 100 milliliters
6. <: less than
7. mg/L: milligrams per liter
8. BOD: biochemical oxygen demand
9. COD: chemical oxygen demand
10. MBAS: methylene blue active substances
11. TSS: total suspended solids

3.5.1.3 Electrical/Communication Vaults

Two utility vaults (Vault 2 and Vault 3) observed discharging into the Center Corridor stormwater collection system were sampled on April 9, 2018, and May 17, 2018, to see if these vaults are a potential source of COCs.

On July 11 and 12, 2018, grab-samples were collected by MCSP staff from 16 utility vaults (C-2, C-3, C-4, C-5, C-6, C-7, C-8, C-9, C-10, C-13, C-14, C-15, C-16, C-17, C-19, and C-20) within the Main Outfall drainage basin (Figure 1-7). Table 3.5-3 summarizes select results from utility vaults within the Main Drainage Basin.

Table 3.5-3 Main Drainage Basin Utility Vault Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	20	1	5.0	5.0
VOCs[3] (ug/L)				
Chloroform	20	4	0.93	1.7
Dichlorodifluoromethane	20	1	1.5	1.5
SVOCs[4] (ug/L)				
SVOCs	18	0	--[5]	--
Microbial (MPN/100ml)[6]				
Fecal Coliform	20	6	141	920
Total Coliform	20	18	262	>1,600[7]
E. Coli	20	4	14	65
General Chemistry (mg/L)				
Ammonia	20	0	--	--
BOD[8]	20	0	--	--
COD[9]	20	2	110	110
MBAS[10]	20	0	--	--
TSS[11]	20	18	7	46
Phosphorus	20	20	0.15	0.53
Metals (ug/L)				
Aluminum	20	15	667	4,500
Iron	20	14	1,132	4,300
Magnesium	20	19	10,879	36,000
Zinc	20	16	215	700

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. VOC: volatile organic compound
4. SVOC: semi-volatile organic compound
5. --: not applicable
6. MPN/100ml: most probably number per 100 milliliters
7. >: greater than
8. BOD: biochemical oxygen demand
9. COD: chemical oxygen demand
10. MBAS: methylene blue active substances
11. TSS: total suspended solids

3.5.1.4 Landscape Irrigation Runoff

On July 18, 2018, MCSP staff collected grab-samples from drop inlets P161, P166, and PO A1, at approximately 1:30 am and 3:00 am near the end of scheduled landscape irrigation times to assess pesticide, herbicide, and fertilizer concentrations, if any, in landscape irrigation runoff. Table 3.5-4 summarizes select results from three drop inlets within the Main Drainage Basin.

Table 3.5-4 Main Drainage Basin Landscape Irrigation Runoff Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
TPH-kerosene[2]	3	0	--[3]	--
EPA 547 (ug/L)				
Glyphosate ug/L	3	3	817	2,100
EPA 8081A (ppm)[4]				
Pesticides	3	0	--	--
EPA 8081A with Pyrethroids (ppm)				
Pesticides	3	0	--	--
EPA 632 (ppm)				
Carbamates	3	0	--	--
EPA 8151 A (ppm)				
Tryiclopyr	3	1	17.7	17.7
Fertilizer components (mg/L)[5]				
Nitrate as N	3	3	0.42	0.58
Phosphate	3	3	2.0	2.5
Potassium	3	3	4.6	6.3

1. ug/L: micrograms per liter
2. TPH-kerosene: total petroleum hydrocarbons as kerosene
3. --: not applicable
4. ppm: parts per million
5. mg/L: milligrams per liter

Irrigation runoff sample results detected the herbicides glyphosate (Roundup®) and fertilizer chemical-components (nitrogen, phosphorous, and potassium) at each discharge location sampled. The herbicide triclopyr was detected in sample DI-P166. Glyphosate does not exceed one-tenth of the 96-hour LC50 value for aquatic organisms (5,500 ug/L; CVRWQCB, May 2018). Triclopyr does not exceed one-tenth of the 96-hour LC50 value for aquatic organisms (2,000 ug/L; CVRWQCB, May 2018). Glyphosate high of 2,100 ug/L was an outlier at PO A1 which skewed data averages.

3.5.1.5 GT-2

From January 2018 through August 2019, approximately 11 samples were collected from GT-2. Table 3.5-5 summarizes select results from GT-2 within the Main Drainage Basin.

Table 3.5-5 GT-2 Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	11	6	2.7	3.7
TPHD[3]	11	6	81	100
VOCs[4] (ug/L)				
Toluene	11	1	1.4	1.4
Ethylbenzene	11	1	0.77	0.77
Total xylenes	11	2	3.4	4.8
Chloroform	5	1	0.72	0.72
Acetone	5	3	8.03	14
Methyl ethyl ketone	5	1	1.8	1.8
SVOCs[5] (ug/L)				
Di-n-butyl phthalate	3	1	0.96-J[6]	0.96-J
Diethyl phthalate	3	1	0.42-J	0.42-J
Microbial (MPN/100ml)[7]				
Fecal Coliform	10	10	960	>1,600
Total Coliform	10	10	>1,600[8]	>1,600
E. Coli	10	10	1,109	>2,419.6
General Chemistry (mg/L)				
Ammonia	11	3	1.1	1.5
BOD[9]	11	5	6.9	12
COD[10]	11	8	57	94
MBAS[11]	11	1	0.1	0.1
TSS[12]	11	11	157	530
Phosphorus	11	7	0.6	1.3
Metals (ug/L)				
Aluminum	11	11	3,711	10,000
Iron	11	11	6,064	22,000
Magnesium	11	11	8,200	11,000
Zinc	11	11	50	130

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. TPHD: total petroleum hydrocarbons as diesel
4. VOC: volatile organic compound
5. SVOC: semi-volatile organic compound
6. J: estimated value
7. MPN/100ml: most probably number per 100 milliliters
8. >: greater than
9. BOD: biochemical oxygen demand
10. COD: chemical oxygen demand
11. MBAS: methylene blue active substances
12. TSS: total suspended solids

3.5.1.6 GT-3

From January 2018 through August 2019, approximately 283 samples were collected from GT-3. Table 3.5-6 summarizes select results from Tower 3 within the Main Drainage Basin.

Table 3.5-6 GT-3 (Guard Tower 3, Junction / Outfall, Main Outfall) Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	268	102	3.91	66.5
TPHD[3]	268	42	213	1,400
VOCs[4] (ug/L)				
Benzene	268	1	0.42	0.42
Toluene	268	1	1.70	1.70
Total xylenes	268	1	1.70	1.70
Chloroform	212	11	2.18	11
Bromoform	212	2	1.65	2.1
DBCM[5]	212	1	0.97	0.97
BDCM[6]	212	1	0.78	0.78
Acetone	212	22	7.44	26
Methyl ethyl ketone	212	3	1.42	1.80
Naphthalene	212	1	0.71	0.71
SVOCs[7] (ug/L)				
Benzoic Acid	170	2	8.4-J[8]	11-J
Bis (2-ethylhexyl) phthalate	170	1	4.4-J	4.4-J
Butyl benzyl phthalate	170	1	4.8-J	4.8-J
Di-n-butyl phthalate	170	4	2.7-J	5.8-J
Diethyl phthalate	170	3	0.82-J	1.2-J
Pentachlorophenol	170	2	4.4-J	4.4-J

Table 3.5-6 Continued **GT-3 (Guard Tower 3, Junction / Outfall, Main Outfall) Select Results Mule Creek State Prison, Ione, California**

Constituent	# Samples	# Detections	Average	Maximum
Microbial (MPN/100ml)[9]				
Fecal Coliform	274	273	2,005	160,000
Total Coliform	274	273	8,155	>160,000[10]
E. Coli	283	272	1,213	72,700
General Chemistry (mg/L)				
Ammonia	268	25	0.53	2.60
BOD[11]	268	77	11.2	140
COD[12]	233	142	66	1,100
MBAS[13]	234	89	0.31	13
TSS[14]	268	238	45	1,600
Phosphorus	234	201	0.67	11
Metals (ug/L)[15]				
Aluminum	269	253	2,725	470,000
Iron	269	250	1,729	57,000
Magnesium	269	269	9,948	19,000
Zinc	269	269	624	2,700

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. TPHD: total petroleum hydrocarbons as diesel
4. VOC: volatile organic compound
5. DBCM: dibromochloromethane
6. BDCM: bromodochloromethane
7. SVOC: semi-volatile organic compound
8. J: estimated value
9. MPN/100ml: most probably number per 100 milliliters
10. >: greater than
11. BOD: biochemical oxygen demand
12. COD: chemical oxygen demand
13. MBAS: methylene blue active substances
14. TSS: total suspended solids
15. ug/L: micrograms per liter

3.5.1.7 GT-4

From January 2018 through August 2019, approximately 229 samples were collected from GT-4. Table 3.5-7 summarizes select results from GT-4 within the Main Drainage Basin.

Table 3.5-7 GT-4 Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	229	77	12.49	650
TPHD[3]	229	44	208	960
TPHG[4]	83	1	64	64
VOCs[5] (ug/L)				
Benzene	229	1	0.42	0.42
Toluene	229	2	1.65	1.7
Ethylbenzene	229	1	0.57	0.57
Total xylenes	229	3	2.24	4.2
Chloroform	189	10	1.91	5.0
Acetone	189	24	7.88	33
Methyl ethyl ketone	189	2	1.75	1.8
Naphthalene	189	1	0.70	0.70
SVOCs[6] (ug/L)				
Benzoic Acid	147	1	5.6-J[7]	5.6-J
Bis (2-chloroethyl) ether	147	2	0.49-J	0.53-J
Bis (2-ethylhexyl) phthalate	147	5	6.53	18
Butyl benzyl phthalate	147	1	13	13
Di-n-butyl phthalate	147	3	1.17-J	1.4-J
Di-n-octyl phthalate	147	1	3.0-J	3.0-J
Diethyl phthalate	147	5	0.42-J	0.68-J

Table 3.5-7 GT-4 Select Results
Continued Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Microbial (MPN/100ml)[8]				
Fecal Coliform	228	223	1,086	>1,600[9]
Total Coliform	228	228	1,676	24,000
E. Coli	227	225	859	2,420
General Chemistry (mg/L)				
Ammonia	229	24	0.43	1.8
BOD[10]	229	88	11.9	140
COD[11]	229	138	68	340
MBAS[12]	229	92	0.22	2.7
TSS[13]	229	198	51.3	4,200
Phosphorus	229	199	0.71	3.2
Metals (ug/L)				
Aluminum	229	214	662	18,000
Iron	229	208	1,264	42,000
Magnesium	229	229	10,258	21,000
Zinc	229	205	106	1,300

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. TPHD: total petroleum hydrocarbons as diesel
4. TPHG: total petroleum hydrocarbons as gasoline
5. VOC: volatile organic compound
6. SVOC: semi-volatile organic compound
7. J: estimated value
8. MPN/100ml: most probably number per 100 milliliters
9. >: greater than
10. BOD: biochemical oxygen demand
11. COD: chemical oxygen demand
12. MBAS: methylene blue active substances
13. TSS: total suspended solids

3.5.1.8 GT-5

From January 2018 through August 2019, approximately six samples were collected from GT-5. Table 3.5-8 summarizes select results from GT-5 within the Main Drainage Basin.

Table 3.5-8 GT-5 (Guard Tower 5) Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Petroleum	1	0	--[2]	--
VOCs[3] (ug/L)				
VOCs	1	0	--	--
SVOCs[4] (ug/L)				
SVOCs	1	0	--	--
Microbial (MPN/100ml)[5]				
Fecal Coliform	1	1	4.5	4.5
Total Coliform	1	1	1,600	1,600
E. Coli	1	1	12.1	12.1
General Chemistry (mg/L)[6]				
Ammonia	1	0	--	--
BOD[7]	1	0	--	--
COD[8]	--	--	--	--
MBAS[9]	1	0	--	--
TSS[10]	1	1	3.1	3.1
Phosphorus	1	1	0.097	0.097
Metals (ug/L)				
Metals	--	--	--	--

1. ug/L: micrograms per liter
2. --: not applicable
3. VOC: volatile organic compound
4. SVOC: semi-volatile organic compound
5. MPN/100ml: most probably number per 100 milliliters
6. mg/L: milligrams per liter
7. BOD: biochemical oxygen demand
8. COD: chemical oxygen demand
9. MBAS: methylene blue active substances
10. TSS: total suspended solids

3.5.2 Main Drainage Basin Conveyance to Mule Creek Water Sampling Results

Stormwater releases from the Main Drainage Basin discharge into Mule Creek through a vegetated drainage swale. Beginning in March 2019, samples were collected from the Main Drainage Basin conveyance at times of sufficient flow.

3.5.2.1 MCSP6

From March 2019 through August 2019, approximately three samples were collected from MCSP6. Table 3.5-9 summarizes select results from MCSP6 within the Main Drainage Basin conveyance.

Table 3.5-9 MCSP6 Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	1	1	1.8-J[3]	1.8-J
VOCs[4] (ug/L)				
VOCs	1	0	--[5]	--
SVOCs[6] (ug/L)				
SVOCs	1	0	--	--
Microbial (MPN/100ml)[7]				
Fecal Coliform	1	1	170	170
Total Coliform	1	1	54,000	54,000
E. Coli	3	3	127	228
General Chemistry (mg/L)				
Ammonia	1	0	--	--
BOD[8]	1	0	--	--
COD[9]	--	--	--	--
MBAS[10]	--	--	--	--
TSS[11]	1	1	3.5	3.5
Phosphorus	0	--	--	--
Metals (ug/L)				
Aluminum	1	1	110	110
Iron	1	1	340	340
Magnesium	1	1	12,000	12,000
Zinc	1	1	550	550

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. J: estimated value
4. VOC: volatile organic compound
5. --: not applicable
6. SVOC: semi-volatile organic compound
7. MPN/100ml: most probably number per 100 milliliters
8. BOD: biochemical oxygen demand
9. COD: chemical oxygen demand
10. MBAS: methylene blue active substances
11. TSS: total suspended solids

3.5.2.3 MCSP3

From January 2018 through August 2019, approximately four samples were collected from MCSP3. Table 3.5-10 summarizes select results from MCSP3 within the Main Drainage Basin conveyance.

Table 3.5-10 MCSP3 Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	1	1	2.2-J[3]	2.2-J
VOCs[4] (ug/L)				
VOCs	1	0	--[5]	--
SVOCs[6] (ug/L)				
SVOCs	1	0	--	--
Microbial (MPN/100ml)[7]				
Fecal Coliform	2	2	18,700	35,000
Total Coliform	2	2	>160,000[8]	>160,000
E. Coli	3	3	23,458	34,480
General Chemistry (mg/L)				
Ammonia	1	0	--	--
BOD[9]	1	1	4.1	4.1
COD[10]	0	--	--	--
MBAS[11]	0	--	--	--
TSS[12]	1	1	65	65
Phosphorus	0	--	--	--
Metals (ug/L)				
Aluminum	1	1	1,900	1,900
Iron	1	1	4,000	4,000
Magnesium	1	1	5,100	5,100
Zinc	1	1	270	270

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. J: estimated value
4. VOC: volatile organic compound
5. --: not applicable
6. SVOC: semi-volatile organic compound
7. MPN/100ml: most probably number per 100 milliliters
8. >: greater than
9. BOD: biochemical oxygen demand
10. COD: chemical oxygen demand
11. MBAS: methylene blue active substances
12. TSS: total suspended solids

3.5.3 Secondary Drainage Basin Water Sampling Results

Water samples were collected during this investigation from locations that are considered representative of the Secondary Drainage Basin including various electrical and communication vaults, irrigation runoff into drop inlets, and GT-9. These water samples are representative of both stormwater and potential non-stormwater in the stormwater collection system. A site map showing these sample locations is included as Figure 1-5.

3.5.3.1 Electrical/Communications Vaults

On July 11 and 12, 2018, MCSP staff collected grab-samples from four utility vaults (C-12, C-18, C-21, and C-22) within the secondary outfall drainage basin (Figure 1-7). Table 3.5-11 summarizes select results from utility vaults within the Secondary Drainage Basin.

Table 3.5.-11 Secondary Drainage Basin Utility Vault Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Petroleum	4	0	--[2]	--
VOCs[3] (ug/L)				
Trichlorodifluoromethane	4	1	0.68	0.68
SVOCs[4] (ug/L)				
SVOCs	4	0	--	--
Microbial (MPN/100ml)[5]				
Fecal Coliform	4	2	1.8	1.8
Total Coliform	4	4	447	>1,600[6]
E. Coli	4	0	--	--
General Chemistry (mg/L)[7]				
Ammonia	4	0	--	--
BOD[8]	4	0	--	--
COD[9]	4	0	--	--
MBAS[10]	4	1	0.05	0.05
TSS[11]	4	2	7.7	8.2
Phosphorus	4	3	0.11	0.14
Metals (ug/L)				
Aluminum	4	3	191	350
Iron	4	4	600	1,000
Magnesium	4	4	12,100	28,000
Zinc	4	4	199	360

1. ug/L: micrograms per liter
2. --: not applicable
3. VOC: volatile organic compound
4. SVOC: semi-volatile organic compound
5. MPN/100ml: most probably number per 100 milliliters
6. >: greater than
7. mg/L: milligrams per liter
8. BOD: biochemical oxygen demand
9. COD: chemical oxygen demand
10. MBAS: methylene blue active substances
11. TSS: total suspended solids

3.5.3.2 Landscape Irrigation Runoff

On July 18, 2018, MCSP staff collected grab-samples from drop inlet P143 at approximately 1:30 am and 3:00 am near the end of scheduled landscape irrigation times to assess pesticide, herbicide, and fertilizer concentrations, if any, in landscape irrigation runoff. Table 3.5-12 summarizes select results from drop inlet P143 within the Secondary Drainage Basin.

Table 3.5-12 Secondary Drainage Basin Landscape Irrigation Runoff Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
TPH-kerosene[2]	1	0	--[3]	--
EPA[4] 547 (ug/L)				
Glyphosate	1	1	1,300	1,300
EPA 8081A (ppm)[5]				
Pesticides	1	0	--	--
EPA 8081A with Pyrethroids (ppm)				
Pesticides	1	0	--	--
EPA 632 (ppm)				
Carbamates	1	0	--	--
EPA 8151 A (ppm)				
Triclopyr	1	0	--	--
Fertilizer components (mg/L)[6]				
Nitrate as N	1	1	1.1	1.1
Phosphate	1	1	1.6	1.6
Potassium	1	1	4.5	4.5

1. ug/L: micrograms per liter
2. TPH-kerosene: total petroleum hydrocarbons as kerosene
3. --: not applicable
4. EPA: U.S. Environmental Protection Agency
5. ppm: parts per million
6. mg/L: milligrams per liter

Irrigation runoff sample results detected the herbicides glyphosate (Roundup®) and fertilizer chemical-components (nitrogen, phosphorous, and potassium) the discharge location sampled. Glyphosate does not exceed one-tenth of the 96-hour LC50 value for aquatic organisms (5,500 ug/L; CVRWQCB, May 2018).

3.5.3.3 GT-9

From January 2018 through August 2019, approximately 28 samples were collected from GT-9. Table 3.5-13 summarizes select results from GT-9 within the Secondary Drainage Basin.

Table 3.5-13 GT-9 (Guard Tower 9, Secondary Outfall, SO) Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	28	17	2.4	5.2
TPHD[3]	27	7	347	1,600
VOCs[4] (ug/L)				
Acetone	22	2	5.7	9.2
Methyl ethyl ketone	22	1	0.86-J[5]	0.86-J
SVOCs[6] (ug/L)				
Di-n-butyl phthalate	20	2	2.2-J	3.1-J
Diethyl phthalate	20	4	0.52-J	1.0-J
Pentachlorophenol	20	1	10-J	10-J
Phenol	20	1	1.4-J	1.4-J
Microbial (MPN/100ml)[7]				
Fecal Coliform	28	28	2,101	>16,000[8]
Total Coliform	28	28	37,376	>160,000
E. Coli	28	27	1,337	6,910
General Chemistry (mg/L)				
Ammonia	28	7	0.41	0.93
BOD[9]	28	13	7.06	15
COD[10]	11	8	54	89
MBAS[11]	11	2	0.18	0.21
TSS[12]	28	28	209	1,800
Phosphorus	11	5	0.35	0.57
Metals (ug/L)				
Aluminum	28	28	2,676	17,000
Iron	28	28	6,955	56,000
Magnesium	28	28	8,511	15,000
Zinc	28	28	105	610

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. TPHD: total petroleum hydrocarbons as diesel
4. VOC: volatile organic compound
5. J: estimated value
6. SVOC: semi-volatile organic compound
7. MPN/100ml: most probably number per 100 milliliters
8. >: greater than
9. BOD: biochemical oxygen demand
10. COD: chemical oxygen demand
11. MBAS: methylene blue active substances
12. TSS: total suspended solids

3.5.4 Secondary Outfall Conveyance to Mule Creek Water Sampling Results

Stormwater releases from the Secondary Drainage Basin discharge through two culverts at the GT-9 collection basin and into a vegetated drainage swale prior to emptying into Mule Creek. Beginning in March 2019, samples were collected from the discharge end of the culverts (MCSP5) and the drainage swale (MCSP2) at times of sufficient flow.

3.5.4.1 MCSP5

From March 2019 through August 2019, up to 14 samples were collected from MCSP5. Table 3.5-14 summarizes select results from MCSP5.

Table 3.5-14 MCSP5 Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	4	4	2.6	3.6
VOCs[3] (ug/L)				
Chloroform	4	1	0.58	0.58
SVOCs[4] (ug/L)				
Di-n-butyl phthalate	4	1	2.8-J[5]	2.8-J
Microbial (MPN/100ml)[6]				
Fecal Coliform	5	5	10,860	54,000
Total Coliform	5	5	46,960	>160,000[7]
E. Coli	14	12	3,752	43,520
General Chemistry (mg/L)				
Ammonia	4	0	--[8]	--
BOD[9]	4	2	2.9	3.3
COD[10]	--	--	--	--
MBAS[11]	--	--	--	--
TSS[12]	4	4	329	1,300
Phosphorus	--	--	--	--
Metals (ug/L)				
Aluminum	4	4	7,126	28,000
Iron	4	4	35,313	140,000
Magnesium	4	4	10,825	16,000
Zinc	4	4	1,162	4,500

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. VOC: volatile organic compound
4. SVOC: semi-volatile organic compound
5. J: estimated value
6. MPN/100ml: most probably number per 100 milliliters
7. >: greater than
8. --: not applicable
9. BOD: biochemical oxygen demand
10. COD: chemical oxygen demand
11. MBAS: methylene blue active substances
12. TSS: total suspended solids

3.5.4.2 MCSP2

From March 2019 through August 2019, up to 5 samples were collected from MCSP2. Table 3.5-15 summarizes select results from MCSP2.

Table 3.5-15 MCSP2 Results January 2018 to August 2019
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	1	1	2.5	2.5
VOCs[3] (ug/L)				
VOCs	1	0	--[4]	--
SVOCs[5] (ug/L)				
SVOCs	1	0	--	--
Microbial (MPN/100ml)[6]				
Fecal Coliform	3	3	11,067	24,000
Total Coliform	3	3	110,333	>160,000[7]
E. Coli	5	5	8,833	22,820
General Chemistry (mg/L)				
Ammonia	1	0	--	--
BOD[8]	1	1	4.3	4.3
COD[9]	--	--	--	--
MBAS[10]	--	--	--	--
TSS[11]	1	1	84	84
Phosphorus	--	--	--	--
Metals (ug/L)				
Aluminum	1	1	1,700	1,700
Iron	1	1	4,500	4,500
Magnesium	1	1	4,400	4,400
Zinc	1	1	73	73

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. VOC: volatile organic compound
4. --: not applicable
5. SVOC: semi-volatile organic compound
6. MPN/100ml: most probably number per 100 milliliters
7. >: greater than
8. BOD: biochemical oxygen demand
9. COD: chemical oxygen demand
10. MBAS: methylene blue active substances
11. TSS: total suspended solids

3.5.5 Mule Creek Water Sampling Results

From January 2018 to August 2019, approximately 83 samples were collected from three separate locations along Mule Creek (upstream, midstream, and downstream).

3.5.5.1 Upstream

From January 2018 through August 2019 up to 34 samples were collected from the farthest upstream location on Mule Creek within the prison property. Table 3.5-16 summarizes select results from all samples collected from the upstream location. These results include samples collected during storm events and non-storm events.

Table 3.5-16 Upstream (MCSP1, Mule Creek NP) Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	19	10	2.46	8.6
VOCs[3] (ug/L)				
Acetone	19	1	5.9	5.9
SVOCs[4] (ug/L)				
Di-n-butyl phthalate	18	2	4.1-J[5]	5.5-J
Microbial (MPN/100ml)[6]				
Fecal Coliform	23	23	847	3,500
Total Coliform	23	23	10,048	35,000
E. Coli	34	34	509	3,130
General Chemistry (mg/L)				
Ammonia	19	0	--[7]	--
BOD[8]	19	2	3.1	3.6
COD[9]	1	0	--	--
MBAS[10]	1	0	--	--
TSS[11]	19	17	9.18	56
Phosphorus	1	0	--	--
Metals (ug/L)				
Aluminum	19	17	213	620
Iron	19	16	510	1,600
Magnesium	19	19	25,211	50,000
Zinc	19	1	5.6	5.6

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. VOC: volatile organic compound
4. SVOC: semi-volatile organic compound
5. J: estimated value
6. MPN/100ml: most probably number per 100 milliliters
7. --: not applicable
8. BOD: biochemical oxygen demand
9. COD: chemical oxygen demand
10. MBAS: methylene blue active substances
11. TSS: total suspended solids

3.5.5.2 Midstream

From January 2018 through August 2019, approximately seven samples were collected from the midstream location on Mule Creek. This sample point is located beneath the bridge for the road leading to the MCIC. Table 3.5-17 summarizes select results from all samples collected from the midstream location. These results include six samples collected during storm events and one non-storm event.

Table 3.5-17 Midstream (Loc-1) Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	7	3	1.7	2.3
VOCs[3] (ug/L)				
All VOCs	6	0	--[4]	--
SVOCs[5] (ug/L)				
All SVOCs	2	0	--	--
Microbial (MPN/100ml)[6]				
Fecal Coliform	7	7	980	>1,600[7]
Total Coliform	7	7	>1,600	>1,600
E. Coli	7	7	1,197	>2,419.6
General Chemistry (mg/L)				
Ammonia	7	0	--	--
BOD[8]	7	2	2.7	3.4
COD[9]	7	4	25	49
MBAS[10]	7	0	--	--
TSS[11]	7	5	9.9	28
Phosphorus	7	5	0.06	0.11
Metals (ug/L)				
Aluminum	7	4	524	1,000
Iron	7	4	1,003	2,300
Magnesium	7	7	19,143	26,000
Zinc	7	1	6.3	6.3

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. VOC: volatile organic compound
4. --: not applicable
5. SVOC: semi-volatile organic compound
6. MPN/100ml: most probably number per 100 milliliters
7. >: greater than
8. BOD: biochemical oxygen demand
9. COD: chemical oxygen demand
10. MBAS: methylene blue active substances
11. TSS: total suspended solids

3.5.5.3 Downstream

From January 2018 through August 2019, up to 42 samples were collected from the downstream location on Mule Creek. This sample point is located beneath the Highway 104 bridge just south the prison property line. Table 3.5-18 summarizes select results from all samples collected from the downstream location. These results include samples collected during storm events and non-storm events.

Table 3.5-18 Downstream (Loc-3, MCSP4, MCDS) Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	27	14	2.29	6
TPHD[3]	26	1	730	730
Motor Oil	18	1	490	490
VOCs[4] (ug/L)				
Chloroform	26	1	1.1	1.1
Acetone	26	4	6.3	10
SVOCs[5] (ug/L)				
Di-n-butyl phthalate	22	3	3.0-J[6]	5.2-J
Di-n-octyl phthalate	22	2	0.6-J	0.64-J
Microbial (MPN/100ml)[7]				
Fecal Coliform	31	31	2,355	17,000
Total Coliform	31	31	39,796	>160,000[8]
E. Coli	42	41	1,514	7,490
General Chemistry (mg/L)				
Ammonia	27	4	0.41	0.93
BOD[9]	27	13	4.6	21
COD[10]	8	6	40	81
MBAS[11]	8	4	0.08	0.12
TSS[12]	27	26	35	160
Phosphorus	8	6	0.24	0.72
Metals (ug/L)				
Aluminum	27	27	1,088	4,700
Iron	27	27	2,115	9,100
Magnesium	27	27	14,900	28,000
Zinc	27	14	92	400

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. TPHD: total petroleum hydrocarbons as diesel
4. VOC: volatile organic compound
5. SVOC: semi-volatile organic compound
6. J: estimated value
7. MPN/100ml: most probably number per 100 milliliters
8. >: greater than
9. BOD: biochemical oxygen demand
10. COD: chemical oxygen demand
11. MBAS: methylene blue active substances
12. TSS: total suspended solids

3.5.6 Microbial Source Tracking Sampling Results

As part of this investigation, both qualitative and quantitative analyses for the presence and type of biomarkers were performed in an attempt to identify sources of fecal contaminants. The qualitative analysis was performed by Source Molecular of Miami, Florida, and the quantitative analysis was performed by SCCWRP of Huntington Beach, California.

3.5.6.1 Biomarker Sampling Results SMC 2018

From March 28, 2018, to October 17, 2018, approximately 31 water samples were collected for qualitative analysis of fecal source identification. Table 3.5-19 summarizes results from all water samples collected for the biomarker analysis except the sample collected at the headworks (untreated sewage).

Table 3.5-19 Biomarker Qualitative Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections
Human Biomarker		
HF 183[1]	31	2
EPA[2]	14	0
Non-Human Biomarker		
Bird	27	22
Gull	5	0
Ruminant	5	0

1. HF183: Human specific bacteroidetes ID Species
2. EPA: Human Bacteroidetes ID: EPA developed assay targets a functional gene biomarker in Bacteroidales-like anaerobic bacteria.

3.5.6.2 Biomarker Sampling Results SCCWRP 2019

From March 2019 to August 2019, approximately 44 water samples were collected for quantitative analysis of fecal source identification. These quantitative results from the implementation of the SCCWRP Study Plan will be submitted under separate cover in 2020 following additional sampling and analysis.

3.5.7 Baseline Water Sampling Results

Water samples were collected to establish baseline conditions from the domestic water supply and wastewater effluent from MCSP to compare analytical results with the water samples collected from the main and Secondary Drainage Basin sampling locations and points of compliance.

3.5.7.1 Domestic Water Sampling

A baseline water sample was collected from a water spigot in MCSP's Center Corridor on March 28, 2018; and from a water spigot at the WWTP offices on June 12, 2018. Table 3.5-20 summarizes select results from the domestic water supply sampling.

Table 3.5-20 Domestic Water Supply (Baseline) Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	1	1	7.0	7.0
VOCs[3] (ug/L)				
Chloroform	2	2	24	27
Bromoform	2	1	2.2	2.2
DBCM[4]	2	1	1.2	1.2
BDCM[5]	2	2	1.4	1.5
SVOCs[6] (ug/L)				
SVOCs	2	0	--[7]	--
Microbial (MPN/100ml)[8]				
Fecal Coliform	2	0	--	--
Total Coliform	2	0	--	--
E. Coli	2	0	--	--
General Chemistry (mg/L)				
Ammonia	2	0	--	--
BOD[9]	2	0	--	--
COD[10]	1	0	--	--
MBAS[11]	2	1	0.07	0.07
TSS[12]	2	0	--	--
Phosphorus	2	2	0.32	0.34
Metals (ug/L)				
Aluminum	1	0	--	--
Iron	1	0	--	--
Magnesium	1	0	--	--
Zinc	1	0	--	--

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. VOC: volatile organic compound
4. DBCM: dibromochloromethane
5. BDCM: bromodochloromethane
6. SVOC: semi-volatile organic compound
7. --: not applicable
8. MPN/100ml: most probably number per 100 milliliters
9. BOD: biochemical oxygen demand
10. COD: chemical oxygen demand
11. MBAS: methylene blue active substances
12. TSS: total suspended solids

3.5.7.2 Wastewater Treatment Plant Sampling

To establish baseline conditions at the WWTP, one sample was collected from the secondary clarifier (secondary effluent) on April 27, 2018; and two samples were collected from the chlorine contact chambers (Effluent A and Effluent B) on June 12, 2018. Table 3.5-21 summarizes select results from the WWTP sampling.

Table 3.5-21 Wastewater Treatment Plant Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Petroleum	3	0	--[2]	--
VOCs[3] (ug/L)				
Chloroform	3	2	2.5	3.0
Acetone	3	1	7.8	7.8
SVOCs[4] (ug/L)				
SVOCs	3	0	--	--
Microbial (MPN/100ml)[5]				
Fecal Coliform	3	1[6]	1,600	1,600
Total Coliform	3	1[6]	>1,600[7]	>1,600
E. Coli	3	1[6]	1,046.20	1,046.20
General Chemistry (mg/L)				
Ammonia	3	3	5.1	6.2
BOD[8]	3	1[6]	8.7	8.7
COD[9]	3	0	--	--
MBAS[10]	3	0	--	--
TSS[11]	3	3	11	13
Phosphorus	3	3	4.4	4.7
Metals (ug/L)				
Aluminum	3	3	120	180
Iron	3	3	213	330
Magnesium	3	3	2,600	3,500
Zinc	3	3	141	260

1. ug/L: micrograms per liter
2. --: not applicable
3. mg/L: milligrams per liter
4. SVOC: semi-volatile organic compound
5. MPN/100ml: most probably number per 100 milliliters
6. These detections were at the secondary effluent which is prior to full treatment at the WWTP.
7. >: greater than
8. BOD: biochemical oxygen demand
9. COD: chemical oxygen demand
10. MBAS: methylene blue active substances
11. TSS: total suspended solids

3.5.7.3 Former Sanitary Sewer Lift Station

During the July 11 and 12, 2018, electrical utility vault sampling, a sanitary sewer lift station was inadvertently sampled near the B-7 building and labeled as Vault 4. This lift station was located in the B Yard, shown as SSMH-V4 on Figure 1-6, and CCTV results demonstrate this is not part of the stormwater collection system. In summer of 2019, the Vault 4 lift station structure was removed and converted back to a gravity sanitary sewer, for line segment B7B , as originally designed. Table 3.5-22 summarizes select results from SSMH-V4 (Vault 4).

Table 3.5-22 Sewer Lift Station (Vault 4) Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Petroleum	1	0	--[2]	--
VOCs[3] (ug/L)				
Acetone	1	1	12,000	12,000
SVOCs[4] (ug/L)				
SVOCs	1	0	--	--
Microbial (MPN/100ml)[5]				
Fecal Coliform	1	1	1,600	1,600
Total Coliform	1	1	>1,600[6]	>1,600
E. Coli	1	0	<1.0[7]	<1.0
General Chemistry (mg/L)[8]				
Ammonia	1	1	5.4	5.4
BOD[9]	1	1	>40	>40
COD[10]	1	1	270	270
MBAS[11]	1	1	0.22	0.22
TSS[12]	1	1	36	36
Phosphorus	1	1	0.43	0.43
Metals (ug/L)				
Aluminum	1	1	51	51
Iron	1	1	7,500	7,500
Magnesium	1	0	<100	<100
Zinc	1	0	--	--

1. ug/L: micrograms per liter
2. --: not applicable
3. VOC: volatile organic compound
4. SVOC: semi-volatile organic compound
5. MPN/100ml: most probably number per 100 milliliters
6. >: greater than
7. <: less than
8. mg/L: milligrams per liter
9. BOD: biochemical oxygen demand
10. COD: chemical oxygen demand
11. MBAS: methylene blue active substances
12. TSS: total suspended solids

3.5.8 Storm Event Sampling

The following section summarizes Mule Creek water sampling results for the upstream, midstream, and downstream locations during rain events greater than 0.30 inches in a 24-hour period. Sampling locations are shown on Figure 1-5. See Tables 2.5-6 through 2.5-8 for defined storm event sampling dates.

3.5.8.1 Upstream

The upstream location on Mule Creek was sampled approximately nine times during the storm events. Table 3.5-23 summarizes select results from storm event sampling upstream on Mule Creek.

Table 3.5-23 Upstream Storm Event Sampling Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	9	4	1.7	2.1
VOCs[3] (ug/L)				
VOCs	9	0	--[4]	--
SVOCs[5] (ug/L)				
SVOCs	9	0	--	--
Microbial (MPN/100ml)[6]				
Fecal Coliform	9	9	1,196	3,500
Total Coliform	9	9	10,924	35,000
E. Coli	10	10	988	3,130
General Chemistry (mg/L)				
Ammonia	9	0	--	--
BOD[7]	9	2	3.05	3.6
COD[8]	--	--	--	--
MBAS[9]	--	--	--	--
TSS[10]	9	9	6.83	14
Phosphorus	--	--	--	--
Metals (ug/L)				
Aluminum	9	9	200	580
Iron	9	8	419	950
Magnesium	9	9	20,222	30,000
Zinc	9	0	--	--

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. VOC: volatile organic compound
4. --: not applicable
5. SVOC: semi-volatile organic compound
6. MPN/100ml: most probably number per 100 milliliters
7. BOD: biochemical oxygen demand
8. COD: chemical oxygen demand
9. MBAS: methylene blue active substances
10. TSS: total suspended solids

3.5.8.2 Midstream

The midstream location on Mule Creek was sampled approximately six times during the storm events. Table 3.5-24 summarizes select results from storm event sampling midstream on Mule Creek.

Table 3.5-24 Midstream Storm Event Sampling Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	6	3	1.7	2.3
VOCs[3] (ug/L)				
VOCs	5	0	--[4]	--
SVOCs[5] (ug/L)				
SVOCs	2	0	--	--
Microbial (MPN/100ml)[6]				
Fecal Coliform	6	6	1,115	1,600
Total Coliform	6	6	>1,600[7]	>1,600
E. Coli	6	6	1,377	>2,419.6
General Chemistry (mg/L)				
Ammonia	6	0	--	--
BOD[8]	6	2	2.7	3.4
COD[9]	6	4	24.75	49
MBAS[10]	6	0	--	--
TSS[11]	6	5	9.92	28
Phosphorus	6	5	0.06	0.11
Metals (ug/L)				
Aluminum	6	4	524	1,000
Iron	6	4	1,003	2,300
Magnesium	6	6	18,167	26,000
Zinc	6	1	6.3	6.3

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. VOC: volatile organic compound
4. --: not applicable
5. SVOC: semi-volatile organic compound
6. MPN/100ml: most probably number per 100 milliliters
7. >: greater than
8. BOD: biochemical oxygen demand
9. COD: chemical oxygen demand
10. MBAS: methylene blue active substances
11. TSS: total suspended solids

3.5.8.3 Downstream

The downstream location on Mule Creek was sampled approximately 17 times during storm events. Table 3.5-25 summarizes select results from storm event sampling downstream on Mule Creek.

Table 3.5-25 Downstream Storm Event Sampling Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	17	8	1.9	3.4
VOCs[3] (ug/L)				
Chloroform	16	1	1.1	1.1
Acetone	16	3	6.1	10
SVOCs[4] (ug/L)				
Di-n-octyl phthalate	13	2	0.62-J[5]	0.64-J
Microbial (MPN/100ml)[6]				
Fecal Coliform	17	17	3,012	17,000
Total Coliform	17	17	49,179	>160,000[7]
E. Coli	18	18	2,767	7,490
General Chemistry (mg/L)				
Ammonia	17	3	0.51	0.93
BOD[8]	17	11	4.9	21
COD[9]	7	5	44	81
MBAS[10]	7	4	0.08	0.12
TSS[11]	17	17	41	160
Phosphorus	7	5	0.28	0.72
Metals (ug/L)				
Aluminum	17	17	1,563	4,700
Iron	17	17	6,681	9,100
Magnesium	17	17	11,494	22,000
Zinc	17	11	110	400

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. VOC: volatile organic compound
4. SVOC: semi-volatile organic compound
5. J: estimated value
6. MPN/100ml: most probably number per 100 milliliters
7. >: greater than
8. BOD: biochemical oxygen demand
9. COD: chemical oxygen demand
10. MBAS: methylene blue active substances
11. TSS: total suspended solids

3.5.8.4 GT-3 Pre-Storm Event Sample Results

GT-3 was sampled approximately 190 times prior to storm events greater than 0.30-inches in 24 hours. Table 3.5-26 summarizes select results from pre-storm event sampling at GT-3.

Table 3.5-26 GT-3 (Guard Tower 3, Junction / Outfall, Main Outfall) Pre-Storm Event Select Results Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	190	64	4.81	66.5
TPHD[3]	190	14	206	1,400
VOCs[4] (ug/L)				
Benzene	189	1	0.42	0.42
Toluene	189	1	1.7	1.7
Total xylenes	189	1	1.7	1.7
Chloroform	165	8	1.47	3.8
Acetone	165	14	5.8	15
Methyl ethyl ketone	165	1	0.85	0.85
Naphthalene	165	1	0.71	0.71
SVOCs[5] (ug/L)				
Benzoic Acid	136	1	11-J[6]	11-J
Bis (2-ethylhexyl) phthalate	136	1	4.4-J	4.4-J
Butyl benzyl phthalate	136	1	4.8-J	4.8-J
Diethyl phthalate	136	1	0.32-J	0.32-J
Microbial (MPN/100ml)[7]				
Fecal Coliform	190	190	933	9,200
Total Coliform	190	190	2,802	>160,000[8]
E. Coli	190	189	626	2,420
General Chemistry (mg/L)				
Ammonia	190	12	0.29	0.70
BOD[9]	190	49	10.7	140
COD[10]	180	102	68.0	1,100
MBAS[11]	180	72	0.35	13
TSS[12]	190	165	21.0	960
Phosphorus	180	171	0.71	11
Metals (ug/L)				
Aluminum	190	176	439	7,500
Iron	190	173	750	18,000
Magnesium	190	190	10,009	19,000
Zinc	190	190	637	1,710

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. TPHD: total petroleum hydrocarbons as diesel
4. VOC: volatile organic compound
5. SVOC: semi-volatile organic compound
6. J: estimated value
7. MPN/100ml: most probably number per 100 milliliters
8. >: greater than
9. BOD: biochemical oxygen demand
10. COD: chemical oxygen demand
11. MBAS: methylene blue active substances
12. TSS: total suspended solids

3.5.8.5 GT-3 During-Storm Event Sample Results

GT-3 was sampled approximately 34 times during storm events. Table 3.5-27 summarizes select results from storm event sampling at GT-3.

Table 3.5-27 GT-3 (Tower 3, Junction / Outfall, Main Outfall) During-Storm Event Select Results Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Oil & Grease (mg/L)[2]	31	17	2.21	4.40
TPHD[3]	30	15	125	230
VOCs[4] (ug/L)				
Chloroform	17	1	11	11
Bromoform	17	1	1.2	1.2
BDCM[5]	17	1	0.78	0.78
Acetone	17	4	12.5	26
Methyl ethyl ketone	17	1	1.6	1.60
SVOCs[6] (ug/L)				
Di-n-butyl phthalate	13	2	2.0-J[7]	2.7-J
Pentachlorophenol	13	2	4.4-J	4.4-J
Microbial (MPN/100ml)[8]				
Fecal Coliform	33	32	8,803	160,000
Total Coliform	33	32	30,622	>160,000[9]
E. Coli	34	33	3,027	38,730
General Chemistry (mg/L)				
Ammonia	32	4	0.77	2.60
BOD[10]	32	11	14.8	130
COD[11]	19	15	63	160
MBAS[12]	19	2	0.065	0.078
TSS[13]	32	31	146	1,600
Phosphorus	19	4	0.30	0.41
Metals (ug/L)				
Aluminum	32	31	17,334	470,000
Iron	32	32	4,479	32,000
Magnesium	32	32	8,741	17,000
Zinc	32	32	414	820

1. ug/L: micrograms per liter
2. mg/L: milligrams per liter
3. TPHD: total petroleum hydrocarbons as diesel
4. VOC: volatile organic compound
5. BDCM: bromodochloromethane
6. SVOC: semi-volatile organic compound
7. J: estimated value
8. MPN/100ml: most probably number per 100 milliliters
9. >: greater than
10. BOD: biochemical oxygen demand
11. COD: chemical oxygen demand
12. MBAS: methylene blue active substances
13. TSS: total suspended solids

3.6 Stormwater Collection Soil Analytical Results

The following sections summarize the soil sampling results from stockpile soil sampling, Perimeter Ditch soil sampling, baseline soil sampling, and molecular source tracking soil sampling.

3.6.1 Stockpile Sample Results

On March 29, 2018, and on June 13, 2018, the soil stockpiles from the MCSP Culvert Installation Project and the MCIC prison expansion were sampled. A summary of select results is presented in Sections 3.6.1.1 and 3.6.1.2.

3.6.1.1 Perimeter Ditch Construction Excavated Soils (SP-1, SP-2, SP-3, and SP-4)

On March 29, 2018, four 4-point composite samples (SP-1 though SP-4) were collected from the Perimeter Ditch construction excavated soils. Table 3.6-1 presents a summary of select results.

Table 3.6-1 Perimeter Ditch Soil Sampling Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (mg/kg)[1]				
TPHD[2]	4	4	1.8	2.6
TPHMO[3]	4	3	3.5	4.7
VOCs[4] (ug/kg)[5]				
VOCs	0	--[6]	--	--
SVOCs[7] (ug/kg)				
SVOCs	0	--	--	--
Microbial (MPN/100ml)[8]				
Fecal Coliform	4	0	--	--
Total Coliform	4	4	64	170
General Chemistry (mg/kg)				
Ammonia	4	0	--	--
Nitrate as N	4	0	--	--
Phosphorus	4	4	240	310
TKN[9]	4	4	240	260
Metals (mg/kg)				
Aluminum	0	--	--	--
Arsenic	4	4	5.5	7.7
Chromium	4	4	38	48
Iron	0	--	--	--
Lead	4	4	6.2	6.8
Zinc	4	4	58	84

1. mg/kg: milligrams per kilogram
2. TPHD: total petroleum hydrocarbons as diesel
3. TPHMO: total petroleum hydrocarbons as motor oil
4. VOC: volatile organic compound
5. ug/kg: micrograms per kilogram
6. --: not applicable
7. SVOC: semi-volatile organic compound
8. MPN/100ml: most probably number per 100 milliliters
9. TKN: total Kjeldahl nitrogen

3.6.1.2 MCIC Prison Expansion Excavated Soils (SP-6, SP-8, SP-11, SP-12, and SP-14)

On June 13, 2018, 10 4-point composite samples were collected from the MCIC construction excavated soil pile (SP-5 through SP-14). Five 4-point composite samples were selected for initial chemical analyses (SP-6, SP-8, SP-11, SP-12, and SP-14). Table 3.6-2 presents a summary of select results from the MCIC construction excavated soil pile sampling.

Table 3.6-2 MCIC Construction Excavated Soils Sampling Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (ug/L[1] unless noted)				
Petroleum	0	--[2]	--	--
VOCs[3] (ug/kg)[4]				
VOCs	5	0	--	--
SVOCs[5] (ug/kg)				
SVOCs	5	0	--	--
Microbial (MPN/100ml)[6]				
Microbial	0	--	--	--
General Chemistry (mg/kg)[7]				
Ammonia	5	0	--	--
Nitrate as N	5	2	2.8	3.1
Phosphorus	5	5	270	300
TKN[8]	5	5	292	470
Metals (mg/kg)				
Aluminum	5	5	7,140	8,600
Arsenic	5	5	7.3	8.8
Chromium	5	5	46	54
Iron	5	5	28,400	32,000
Lead	5	5	7.2	7.6
Zinc	5	5	48	69

1. ug/L: micrograms per liter
2. --: not applicable
3. VOC: volatile organic compound
4. ug/kg: micrograms per kilogram
5. SVOC: semi-volatile organic compound
6. MPN/100ml: most probably number per 100 milliliters
7. mg/kg: milligrams per kilogram
8. TKN: total Kjeldahl nitrogen

The total metals, toxicity characteristic leaching procedure (TCLP), and de-ionized water (DI-WET) results from the five composite samples analyzed from MCIC stockpile did not exceed any State or Federal regulatory limits for metals; therefore, the decision was made to defer analyzing the remaining five composite samples held at the laboratory.

3.6.2 Perimeter Ditch Soil Sample Results

On March 29, 2018, soil samples were collected from five locations in the Perimeter Ditch (GT-3, GT-3 Outfall, GT-4, between GT-3 and GT-2, and GT-9). On June 12, 2018, soil samples were collected from nine locations in the Perimeter Ditch (GT-1 through GT-9). Table 3.6-3 presents a summary of select results from these two Perimeter Ditch soil sampling events.

Table 3.6-3 Perimeter Ditch Soil Sampling Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (mg/kg)[1]				
TPHD[2]	5	4	18	42
TPHMO[3]	5	4	26	55
VOCs[4] (ug/kg)[5]				
VOCs	9	0	--[6]	--
SVOCs[7] (ug/kg)				
SVOCs	9	0	--	--
Microbial (MPN/100ml)[8]				
Fecal Coliform	5	3	482	1,300
Total Coliform	5	5	126,260	350,000
General Chemistry (mg/kg)				
Ammonia	14	3	16.4	28
Nitrate as N	14	0	--	--
Phosporus	14	14	273	450
TKN[9]	14	5	366	1,000
Metals (mg/kg)				
Aluminum	9	9	4,900	6,600
Arsenic	14	14	8.5	14
Chromium	14	14	38	51
Iron	9	9	28,444	42,000
Lead	14	14	7.1	10
Zinc	14	14	71	130

1. mg/kg: milligrams per kilogram
2. TPHD: total petroleum hydrocarbons as diesel
3. TPHMO: total petroleum hydrocarbons as motor oil
4. VOC: volatile organic compound
5. ug/kg: micrograms per kilogram
6. --: not applicable
7. SVOC: semi-volatile organic compound
8. MPN/100ml: most probably number per 100 milliliters
9. TKN: total Kjeldahl nitrogen

3.6.3 Baseline Soil Sample Results

On April 27, 2018, SHN collected baseline soil samples from five locations on the prison grounds. A summary of the results is presented below. Table 3.6-4 presents a summary of select results from the baseline soil sampling.

Table 3.6-4 Baseline Soils Sampling Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	Average	Maximum
Petroleum (mg/kg)[1]				
TPHD[2]	5	5	10	28
TPHMO[3]	5	4	30	96
VOCs[4] (ug/kg)[5]				
VOCs	0	--[6]	--	--
SVOCs[7] (ug/kg)				
SVOCs	0	--	--	--
Microbial (MPN/100ml)[8]				
Fecal Coliform	5	1	20	20
Total Coliform	5	4	55,448	220,000
General Chemistry (mg/kg)				
Ammonia	5	1	2.5	2.5
Nitrate as N	5	0	--	--
Phosphorus	5	5	239	370
TKN[9]	5	5	1,387	2,100
Metals (mg/kg)				
Aluminum	5	5	7,920	16,000
Arsenic	5	3	9.6	17
Chromium	5	5	22	34
Iron	5	5	31,400	42,000
Lead	5	4	9.2	14
Zinc	5	5	43	53

1. mg/kg: milligrams per kilogram
2. TPHD: total petroleum hydrocarbons as diesel
3. TPHMO: total petroleum hydrocarbons as motor oil
4. VOC: volatile organic compound
5. ug/kg: micrograms per kilogram
6. --: not applicable
7. SVOC: semi-volatile organic compound
8. MPN/100ml: most probably number per 100 milliliters
9. TKN: total Kjeldahl nitrogen

3.6.4 Molecular Source Tracking Soil Sampling Results

On April 27, 2018, SHN collected five baseline soil samples from the prison property and submitted them for qualitative analyses for the presence and type of biomarkers. On June 13, 2018, SHN collected five soil samples from the Perimeter Ditch and MCIC construction excavated soils and submitted them for qualitative analyses for the presence and type of biomarkers. The qualitative analysis was performed by Source Molecular of Miami, Florida. Table 3.6-5 presents a summary of the results of biomarker qualitative analysis.

Table 3.6-5 Biomarker Qualitative Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections
Human Biomarker		
HF 183[1]	10	0
EPA[2]	5	0
Non Human Biomarker		
Bird	5	0

1. HF183: Human specific bacteroidetes ID Species
2. EPA: Human Bacteroidetes ID: EPA developed assay targets a functional gene biomarker in Bacteroidales-like anaerobic bacteria.

4.0 Conclusions

Site investigation efforts did not reveal any direct cross-connections between the stormwater and the sanitary sewer collection systems at MCSP. While inspection of the sanitary sewer collection system identified sections that should be repaired, there was no visual or analytical evidence of stormwater comingled with wastewater, sewage and/or grey water. Item F.2 of the Order (Appendix 6) was not addressed because no cross-connection, pipe break, or other issues that would cause the release of waste constituents to the stormwater collection system were identified. Item F.4 of the Order (Appendix 6) was not addressed because waste constituents were not identified in the stormwater collection system.

4.1 Stormwater and Sanitary Sewer Collection Systems Survey and Mapping

The investigation at MCSP included surveying and mapping the stormwater and sanitary sewer collection systems. The survey included an assessment of the groundwater elevation in relation to the stormwater collection system. Depth to groundwater in monitoring well R-1 on March 7, 2018, was 8.77 feet below the top of the casing, indicating a shallow groundwater potentiometric surface upgradient from the prison facility. Because groundwater typically mimics the surface topography, the shallow groundwater or perched groundwater likely flows beneath the institution at a similar level. As presented on Figures 1-28 and 1-29, the stormwater collection system is at the same or similar elevation as the likely elevation of the shallow groundwater or perched groundwater. Due to the elevation of the stormwater collection system in the Center Corridor and the groundwater elevations measured in monitoring well R-1, groundwater and/or irrigation water are most likely infiltrating into the stormwater collection system.

The survey data collected from the stormwater and sanitary sewer collection systems located in the vicinity of the Interior Perimeter Road, indicate that the stormwater and sanitary sewer lines do not run parallel, they only cross. Additionally, all the stormwater lines crossing the Interior Perimeter Road are located above the sanitary sewer lines, and vertical separation of these line crossings varies from 1.6 to 11.6 feet (Figures 1-13 through 1-17).

During the expanded CCTV activities in 2019, additional structures were identified. These will be surveyed in the fall of 2019 and results will be submitted to the CVRWQCB in the spring of 2020.

4.2 Physical Assessment

The physical inspection of the stormwater and sanitary sewer collection systems did not identify any cross-connections; however, other sources of non-stormwater in the stormwater collection system were identified through this investigation as described in the infiltration discussion below. The 2019 CCTV survey data resulted in revisions to figures for the stormwater and sanitary sewer collection systems.

The table below summarizes locations where infiltration was observed during CCTV survey work and includes rainfall data. Note that weeks 7 and 14 in 2019 were actually infiltration stains and not active infiltration. Active infiltration during dry periods was detected three times.

Table 4.2-1 Summary of Infiltration Observations from CCTV Survey
Mule Creek State Prison, Ione, California

Sequence	Segment	Location	System	Dates	Rainfall (inches)	Area
2018	SWMH 509–SWMH 510	65’ from SWMH 509	Storm Drain	April 11, 2018	0.10	CENTER CORRIDOR-B\C
5-23	CB11–CB12	32.1' from CB12	Storm Drain	April 16–19, 2019	0.71	Warehouse
5-6	P161–P162	54.2' from P161	Storm Drain	April 16–19, 2019	0.71	Outer Perimeter
7-2	INBC193C193	6.1' from C193	Storm Drain	April 30–May 3, 2019	0	C-YARD
9-8	B/C112–WYEC112	0' from B/C112	Storm Drain	May 16–19, 2019	1.64	CENTER CORRIDOR-B\C
9-21	B2-1B	62.1' from main	Sanitary Sewer	May 16–19, 2019	1.64	CENTER CORRIDOR-B\C
9-9	C2-1A	79.5' from C/O	Grease Waste	May 16–19, 2019	1.64	CENTER CORRIDOR-B\C
10-6	A/B121-SDMH505	74.4' from main	Storm Drain	May 22–24, 2019	0.11	CENTER CORRIDOR-A\B
13-24	GT6	82.7' from main	Sanitary Sewer	June 17–21, 2019	0	B-NML
14-23	D110	16.1' from D110	Storm Drain	June 24–28, 2019	0	D-NML
17-11	D51–D41	29.8' from D51	Storm Drain	August 5–9, 2019	0	D-NML
17-12	A42–A43	1.2' from A42	Storm Drain	August 5–9, 2019	0	D-NML

Review of 2018 and 2019 physical assessment and survey data indicates the potential for transfer of water between the stormwater and sanitary sewer collection systems lines in the Center Corridor is unlikely. Realignments have brought some lines closer together, increasing the potential for transfer between the stormwater and sanitary sewer collection systems; however, cross-contamination is unlikely due to clay-type-soils, gravity flowing systems, as well as the horizontal separations where the stormwater and sanitary sewer collection systems are in proximity to each other. No co-located defects were found at crossing locations; additionally, the analytical data from water sampling does not support a finding of cross-contamination.

4.2.1 Stormwater Collection System Physical Assessment

SHN conducted an extensive investigation to determine whether stormwater at MCSP is contaminated with sewage, wastewater, or grey water, including 10 months of daily sampling, followed by 10 months of monthly and rain-event sampling, CCTV, and smoke tests (Figures 1-25 through 1-27) in addition to stormwater flow monitoring, rainfall, and irrigation (see Tables and Graphs in Appendix 4). In the spring of 2019, MCSP installed a flow meter on the irrigation line. A graph showing the relationship between irrigation volumes and surface water flow at GT-3 and GT-9 is presented in Appendix 4. SHN's investigation indicates that both groundwater and irrigation are the most likely sources of non-stormwater within the stormwater collection system as detailed below:

1. The investigation discovered the following sources of groundwater and irrigation infiltration into the stormwater collection system:
   - CCTV investigation discovered a slotted pipe in the stormwater system between SWMH-509 and SWMH-510 with groundwater dripping into the stormwater collection line;
   - CTC building French drain and sump pumps that both direct groundwater into the stormwater collection system;
   - communication/electrical vault sump pumps discharge to the stormwater collection system;
   - CCTV documented additional French drain-type stormwater collection in C and D Yards;
   - documented leaks in the irrigation system;
   - pressure washing the stormwater collection system by "jetting out" the lines as part of the CCTV inspection activities on the weeks of March 26, April 9, May 14, and June 11, 2018, and April through August 2019; and
   - relationship between irrigation and measured flow in the stormwater collection system.

2. CCTV investigation, smoke tests, and dye tests have confirmed there are no cross-connections between the stormwater and the sanitary sewer collection systems.

   The following conclusions are based on physical inspections:

   - The RCP stormwater collection lines from SWMH-506 to GT-4 and SWMH-507C to SWMH-507 have some structural issues, such as hinge-style cracks and the longitudinal cracks; however, infiltration is not significant.
   - The infiltration potential from the cracks in the RCP stormwater collection line is minimal, and the majority of the staining appears to be mineral weeping through minor cracks.

- The PVC stormwater collection lines from SWMH-506 to SWMH-507C, and from SWMH-507 to SWMH-513 have several joint separations, infiltrations stains, and poor lateral seals. Additionally, the connections into the new manhole structures around the pharmacy may not be sealed well; however, stormwater collection systems are not typically "watertight."
- Stormwater collection system lines surrounding the perimeter of the C and D Yards were observed to be corrugated French drain lines with manufactured perforations and designed to collect water. These lines are typically 4 to 6 inches in diameter. The corrugated lines were the most difficult to inspect and clean. These lines had a high frequency of defects that are not considered to be of major concern due to their location and capacity. The yard areas are surrounded by prison population housing units and, therefore, do not pose a threat for illicit discharges.
- Defects associated with installation seem to be more of a problem within the Exterior Perimeter (particularly near the LEF) and yard areas as compared to the off-limits areas.

Overall, the stormwater collection system through the Center Corridor is in fair condition, exhibiting defects consistent with aging infrastructure, proximity to former hot water hydronic lines, and some poor installation practices. Defects were found in the mains, loading dock laterals, and manholes; however, no evidence of direct sewer connections was present.

4.2.2 Sanitary Sewer Collection System Physical Assessment

The following conclusions are based on the CCTV, smoke testing and manhole inspections:

- The entire sanitary sewer line from SSMH-210 to SSMH-205 is undersized and in poor condition. Additionally, the section between SSMH-210 to SSMH-209 has inaccessible bends that could not be fully inspected. This section is close to the stormwater alignment and presents a potential threat for sanitary sewer overflow.
- The entire sanitary sewer line from SSMH-403 to SSMH-13 has sags at almost every lateral connection. Additionally, several significant separations occur from SSMH-401 to SSMH-13. The lateral located at Segment A2-1B (Appendix 15) between SSMH-401 and SSMH-402 also has large joint separations. This segment presents a potential threat to impact groundwater.
- The sewer line from SSMH-109 to SSMH-105 is in reasonably good condition.
- Bulges in the PVC line from SSMH-207 to SSMH-209 appear to be caused by the hydronic system and may present maintenance issues, but they are not a source of exfiltration.
- Smoke testing and manhole inspections identified poor sealing of the manhole joints, risers, and lateral connections.
- Joint defects were the most prevalent type of defect in the sanitary sewer collection system.
- No significant corrosion was observed in the ductile iron lateral lines located under the buildings. Moderate corrosion was discovered and all pipe appears to be intact. No blockages were observed.
- Joint connection issues are apparent where new housing/facility units were built and connected to the existing sewer system. There were poorly installed PVC-to-cast-iron connections at those intertie locations (Appendix 15).

Overall, the sanitary sewer collection system in the Center Corridor appears to be in a comparable state of operation and repair to other systems of similar age in terms of exfiltration.

There are no direct connections between the sanitary sewer and stormwater collection systems based upon this investigation. Additionally, defects in the sanitary sewer collection system are not co-located with defects in the stormwater collection system. See Appendix 15.

4.3 Water Sampling

Water sampling data has been collected from the MCSP facility from January 25, 2018, until August 30, 2019, from various locations within the Main Drainage Basin, Secondary Drainage Basin, both Drainage Basin Conveyances to Mule Creek, as well as Mule Creek in an attempt to identify potential sources of contamination to the stormwater collection system. The investigation has produced no evidence that water within the stormwater collection system is contaminated with sewage, wastewater, or grey water. Discussions of water sampling conclusions follow.

4.3.1 Main and Secondary Drainage Basin Water Sampling

4.3.1.1 Petroleum Results

The predominant petroleum constituent detected during this investigation was oil and grease with 186 detections out of 530 samples collected from the Main Drainage Basin and 17 detections out of 32 samples collected from the Secondary Drainage Basin. Of the 564 samples collected in the Main and Secondary Drainage Basins, only 4 detections of oil and grease were above water quality objectives.

Diesel was detected in 92 out of 531 samples collected from the Main Drainage Basin and 7 out of 31 samples collected from the Secondary Drainage Basin. From February 16, 2018 to March 27, 2018, laboratory results for diesel from Moore-Twinning are laboratory-qualified with flags (AJ) noting the results are heavier hydrocarbons than diesel or that the sample does not display a fuel pattern. After March 27, 2018, Alpha Analytical performed the diesel analysis; and although Alpha Analytical did not flag the diesel results, their chemist agrees that the results are definitely not diesel fuel but more along the lines of a heavy hydrocarbon other than motor oil. See Appendix 18 for emails from Moore Twining and Alpha Chemists.

SHN has identified three potential sources that may be contributing to these petroleum detections: 1) Road runoff from the Exterior Perimeter Road into the Perimeter Ditch; 2) Diesel-powered water pumps within the Perimeter Ditch; and 3) A natural carbon source rather than an anthropogenic source. The temporary diesel-powered water pumps are the likely source of the higher concentration outliers of TPHD and oil and grease; whereas the Eocene Ione Formation, the geologic unit that MCSP was built over, is the likely source for the high percentage of low-concentration detections of TPHD and oil and grease. See Section 1.2.1. The diesel pumps were in place at the Main and Secondary Outfalls from March 22, 2018, through June 12, 2018.

Additional evidence of a non-anthropogenic source for the petroleum detections is that 53% of samples collected at the farthest upstream location on Mule Creek within the prison property and 50% of the samples collected from the prison potable water source detected low levels of oil and grease.

Table 4.3-1 presents the number of samples collected, the number of detections, the water quality objectives, and the number of detections that are above water quality objectives for both drainage basins. See Section 4.3.6 for water quality objective table and rationale for selection.

Table 4.3-1 Drainage Basin Petroleum Totals Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	WQO[1]	# Detections >[2] WQO
Petroleum (ug/L[3] unless noted)				
Oil & Grease (mg/L)[4]	562	203	15 / 25[5]	0 / 4
TPHD[6]	562	99	56	92
TPHG[7]	250	1	5	1

1. WQO: water quality objective
2. >: greater than
3. ug/L: micrograms per liter
4. mg/L: milligrams per liter
5. annual numeric action limit / instantaneous maximum numeric action limit
6. TPHD: total petroleum hydrocarbons as diesel
7. TPHG: total petroleum hydrocarbons as gasoline

4.3.1.2 Volatile Organic Compound Results

Although infrequent, the highest percentage of volatile organic compounds (VOC) detected in stormwater was from trihalomethanes (chloroform, bromoform, dibromochloromethane, and bromodicholormethane) and acetone. Trihalomethance were detected approximately 30 times out of 432 samples or 7% of the time, and acetone was detected 49 times out of 431 samples or 11% of the time. None of these VOC detections were above water quality objectives.

Facility wash-down practices and landscape irrigation runoff are likely the source of the trihalomethane detections as trihalomethanes have been reported in the latest available AWA's annual consumer confidence report (AWA, 2018; Appendix 21).

Domestic uses of the same potable water (such as toilets, showers, and sinks) are not likely the source of these constituents because, as explained above in Section 3.5.6.1, human fecal biomarkers have not been detected. Moreover, if the sanitary sewer collection system were continually discharging into the stormwater collection system, sampling results would have returned recurrent detections of potable water constituents and human fecal markers. In contrast, potable water disinfection constituents have been detected infrequently and qualitative results show that human waste biomarkers have not been detected.

Low concentrations of refrigerant were detected in manholes SWMH-508 and SWMH-505. The refrigerant is likely from condensation runoff from the refrigeration condenser units that are plumbed to the stormwater collection system within the Center Corridor near SWMH-510, SWMH-509, and SWMH-508, or from roof runoff.

Low concentrations of refrigerant were also detected in utility vault E/CMH-C-4, which is near "A" Yard Kitchen refrigerator and "A" Yard and B Yard HVAC system condensate, and in utility vault E/CMH-C-22 that is near the HVAC system condensate for PBX Building-E3 (Figure 1-7). Refrigerant has not been detected at any of the outfalls.

Table 4.3-2 presents the number of samples collected, the number of detections, the water quality objectives, and the number of detections that are above water quality objectives for both drainage basins.

Table 4.3-2 Drainage Basin VOC[1] Totals Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	WQO[2]	# Detections >[3] WQO
VOCs (ug/L)[4]				
Benzene	561	2	1	0
Toluene	561	4	40	0
Ethylbenzene	561	2	30	0
Total xylenes	561	6	20	0
Chloroform	457	26	80	0
Bromoform	457	2	80	0
DBCM[5]	457	1	80	0
BDCM[6]	457	1	80	0
Dichloro-difluoromethane	457	3	0.19	3
Trichloro-fluoromethane	457	1	150	0
Acetone	457	51	6,300	0
Methyl Ethyl Ketone	457	7	4,000	0
Napthlalene	457	2	0.29	2

1. VOC: volatile organic compounds
2. WQO: water quality objective
3. >: greater than
4. ug/L: micrograms per liter
5. DBCM: dibromochloromethane
6. BDCM: bromodochloromethane

4.3.1.3 Semi-Volatile Organic Compound Results

Semi-volatile organic compounds were infrequently detected in the drainage basin samples. Of the 365 samples submitted for analyses, less than 5% resulted in detections of SVOCs. The presence of phthalates that exceeded water quality objectives was approximately 1%.

Table 4.3-3 presents the number of samples collected, the number of detections, the water quality objectives, and the number of detections that are above water quality objectives for both drainage basins.

Table 4.3-3 Drainage Basin SVOC[1] Totals Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	WQO[2]	# Detections >[3] WQO
SVOCs (ug/L)[4]				
Benzoic Acid	365	4	28,000	0
Bis (2-chloroethyl) ether	365	2	0.014	2
Bis (2-ethylhexyl) phthalate	365	6	4	5
Butyl benzyl phthalate	365	2	0.10	2
Di-n-butyl phthalate	365	10	3	2
Di-n-octyl phthalate	365	1	3	1
Diethyl phthalate	365	13	3	0
Pentachlorophenol	365	3	1	3
Phenol	365	1	1	1

1. SVOC: semi-volatile organic compounds
2. WQO: water quality objective
3. >: greater than
4. ug/L: micrograms per liter

4.3.1.4 Coliforms

Coliforms were detected frequently in water samples, which is to be expected. Total coliforms are a group of bacteria that are widespread in nature (animal manure, submerged wood, and soil) and are, therefore, not recommended as an indicator of fecal contamination by the EPA (EPA, 2012). Fecal coliforms are the group of total coliforms that are considered to be present specifically in the gut and feces of warm-blooded animals; however, the presence of these does not differentiate between human and animal as the source of the bacteria. E. coli is the most reliable indicator of fecal contamination because it is specific to fecal material from warm-blooded animals; however, E. coli is still not human-specific and can survive in soil and water for multiple days. Additional testing is required for human fecal identification. Section 3.5.6 presented the qualitative results of the additional testing performed, which suggested the source identification of the coliform detected in daily samples was avian and not human.

Table 4.3-4 presents the number of samples collected, the number of detections, the water quality objectives, and the number of detections that are above water quality objectives for both drainage basins.

Table 4.3-4 Drainage Basin Microbial Totals Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	WQO[1]	# Detections >[2] WQO
Microbial (MPN/100ml)[3]				
Fecal Coliform	571	551	>2.2	534
Total Coliform	571	568	>2.2	567
E. Coli	581	559	>2.2	553

1. WQO: water quality objective
2. >: greater than
3. MPN/100ml: most probably number per 100 milliliters

SCCWRP implemented the SCCWRP Study Plan beginning in March 2019 to identify and quantify the microbial source of coliforms in the stormwater collection system. Additional sampling will occur in the fall of 2019 through the spring of 2020, and SCCWRP will present results in the fall of 2020.

4.3.1.5 General Chemistry

Relative to the industrial general permit (IGP), annual numeric action limits (NAL) for the parameters ammonia, BOD, COD, TSS, and phosphorus averaged concentrations at GT-2 and GT-9 exceed the limits listed in Table 2 of the IGP. Relative to the instantaneous maximum NALs, both TSS and pH exceeded the limits listed in Table 2 of the IGP at least once in the last 12 months at locations within both drainage basins. The highest number of detections above water quality objectives was from total alkalinity and phosphorus.

The total alkalinity detections, the majority of which are above freshwater aquatic life protection WQO, are likely attributable to the increased dissolved minerals within the area and are from a natural source. Conversely, we believe the phosphorus detections may be due to the extensive use of glyphosate at MCSP. Glyphosate is readily removed from soil by microbial metabolic activity, and these processes result in the formation of phosphorus (Hove-Jensen, 2014).

Table 4.3-5 presents the number of samples collected, the number of detections, the water quality objectives, and the number of detections that are above water quality objectives for both drainage basins.

Table 4.3-5 Drainage Basin General Chemistry Totals Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	WQO[1]	# Detections >[2] WQO
General Chemistry (mg/L)[3]				
Ammonia	566	59	1.5	4
Total Alkalinity	560	560	20	547
BOD[4]	566	184	30	8
Chloride	560	554	106	1
COD[5]	510	298	120	27
Specific Conductance	509	509	700	4
MBAS[6]	515	186	0.5	12
Nitrate as N	527	495	10	1
Nitrite as N	514	205	1	2
pH[7]	510	510	6.5 - 8.5	45
Settleable Solids	508	61	1	1
Sulfate as SO4	560	560	250	1
TDS[8]	560	560	500	3
TSS[9]	566	499	100 / 400[10]	45 / 13
Phosphorus	515	441	0.0001	441

1. WQO: water quality objective
2. >: greater than
3. mg/L: milligrams per liter
4. BOD: biological oxygen demand
5. COD: chemical oxygen demand
6. MBAS: methylene blue active substances
7. pH: potential of hydrogen
8. TDS: total dissolved solids
9. TSS: total suspended solids
10. annual numeric action limit / instantaneous maximum numeric action limit

4.3.1.6 Metals

Numerous metals results were above water quality objectives with the highest number of exceedances from aluminum (85%), Iron (69%), magnesium (100%), sodium (44%), and zinc (48%). Metals that are currently above the IGP annual NALs are aluminum, iron, magnesium, and zinc. Graphs of these 4 metals are shown in Appendix 20. The baseline soil sampling results indicate that the metals aluminum, iron, and zinc are likely naturally occurring. Magnesium was not analyzed in the baseline soil samples; however, water results from the upstream sampling location on Mule Creek show that total and dissolved magnesium concentrations are high and that all 19 water samples collected at this location were above water quality objectives for magnesium.

The higher concentrations of aluminum and iron (Ione Formation) and magnesium (Gopher Ridge Formation) are likely due to the geology of the surrounding area. The AWA explains these elevated metals in their source water as naturally occurring as well (Appendix 21). See Section 1.2.1 for additional information on the local geology.

As shown in the graphs in Appendix 20, there is a high correlation of aluminum and iron concentrations with total suspended solids (turbidity) concentrations. This also suggests that the local geology is a source of these metals rather than an industrial source. The graphs in Appendix 20 also show a high correlation of magnesium with total dissolved solids. This suggests that the magnesium concentrations are related to an offsite, ubiquitous source such as the local geology. Zinc, on the other hand, is not likely due to a natural source but could possibly be attributed to galvanized metal such as fencing.

Table 4.3-6 presents the number of samples collected, the number of detections, the water quality objectives, and the number of detections that are above water quality objectives for both drainage basins.

Table 4.3-6 Drainage Basin Metals Totals Select Results
Mule Creek State Prison, Ione, California

Constituent	# Samples	# Detections	WQO[1]	# Detections >[2] WQO
Metals (ug/L)[3]				
Aluminum	563	525	50	481
Antimony	509	79	6	1
Arsenic	561	536	10	86
Barium	442	440	1,000	0
Beryllium	390	5	4	0
Cadmium	561	42	5	3
Calcium	561	561	--[4]	0
Chromium	561	398	50	5
Cobalt	390	315	50	0
Copper	392	390	33.2	25
Iron	563	517	300	391
Lead	561	179	15	3
Magnesium	563	562	64	562
Manganese	509	328	50	84
Mercury	398	4	2	0
Molybdenum	390	384	10	6
Nickel	509	475	100	1
Potassium	45	45	--	0
Selenium	561	29	5	0
Silver	442	6	18.3	0
Sodium	561	561	20,000	247
Thallium	390	4	2	0
Vanadium	435	407	50	5
Zinc	563	535	260	273

1. WQO: water quality objective
2. >: greater than
3. ug/L: micrograms per liter
4. --: not applicable

4.3.1.7 Other Constituents

There was one sample event with two locations that identified caffeine in the stormwater collection system. Water samples from SWMH-502 detected higher concentrations than SWMH-505. SWMH-502 is downgradient from the coffee roasting building, while SWMH-505 is upgradient from the coffee roasting